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Voting by Proxy on the Proposed Increase of Dues in the American Society of Mechanical Engineers.

We are in receipt of another circular letter from the Council of the American Society of Mechanical Engineers regarding the proposed increase of dues. The council have taken legal advice and find that, by the laws of the State, the absentee members are entitled to vote on the question by proxy, in accordance with the opinion advanced in our editorial at page 1173. With this circular letter is included a blank proxy requiring nothing but the filling in of the party selected as the member's representative and the signature of the member and a witness to make it effective.

This measure is now in the shape that it should be. Should the membership decide to increase the dues, we shall cheerfully acquiesce, and should the majority in favor of the increase be a large one we should, in fact, rejoice at the increased usefulness of the society which the enlarged income would make possible. We have been and are, however, consistently and unalterably opposed to a decision on such an important matter in any other way than by a vote of the membership at large, and we are gratified to believe that we have been, in an important degree, instrumental in bringing about such a vote.

Tests of Guns.

It may be considered presumptuous for a mere machinery man to make a suggestion regarding the test of a gun, but nevertheless it seems to us that the recent test of a Gathmann gun was not in all respects just what it might have been. It is a well-known principle among engineers to avoid testing two or more things at the same time, and in this case it seems to us that not only the gun but the target at which the shot was fired was also tested. To say the least of it, it seems to us unnecessary to construct a special and expensive target to be fired at when a gun is to be tested. That is probably necessary when a projectile is to be tested, but if a gun with a given charge imparts to a shot a given initial velocity it can then be well known what the effect of that projectile will be as compared with other similar projectiles, and the projectile need not go into a target to prove what it will do. Accurate instruments are available, and in fact are frequently used, to determine the precise velocity of a discharged shot and this velocity indicates the efficiency of the gun better than the effect of the shot upon any target can possibly do. In this case Mr. Gathmann claims that the gun failed partly on account of the defective shot, a claim which could not be set up if the gun were tested as it seems to us it ought to have been.

The fact that an automobile was driven over a measured mile last Saturday in 51⅘ seconds, or at the rate of nearly 70 miles per hour, is rather startling at first thought, though there is of course no mechanical reason why such a vehicle should not be driven over a smooth, hard and straight road at least as fast as a locomotive. It probably takes more nerve to do it, however, because nothing but steady nerves keeps the automobile upon the track, and at any such speed as that mentioned an instant's failure to keep full and complete control of the steering lever would mean disaster and probably sudden death. It may not improperly be asked what useful purpose such racing serves, but we believe that just as the demands of racing bicyclists tended toward the constant improvement of all bicycles, whether used for racing or not, so the demands of those who wish to experimentally determine how fast a motor-driven vehicle may be driven over a road will tend toward the improvement of all such mchines. The vehicle that made the run referred to is said to have an engine capable of developing 40 horse-power; and, supposing this power to have been developed during the run, that would mean that the frictional and the air resistances together amounted to about 259 pounds.

National Founders' Association.

The National Founders' Association met at the Gilsey House in New York last week and discussed questions of special interest to the association and its members. One of the questions discussed was, "Have contracts with individual employees proved of value," the general consensus of opinion seeming to be that this was exceedingly desirable. All the discussions indicated a very general wish on the part of the members to be on good terms with employees and with properly conducted unions to which they may belong, and it was evident that the general desire was to ascertain how and by what means an amicable adjustment of existing or possible difficulties might be arranged. "Injunctions and their value" was discussed and this question developed considerable diversity of opinion, no definite conclusion being reached. On the question of the desirability of the adoption of shorter hours of labor there was much and very decided difference of opinion.

The following officers were elected: President, W. D. Sergeant, Chicago; vice-president, F. T. Towne, Stamford, Conn.; treasurer, John R. Russel, Detroit; secretary, John A. Penton, Detroit.

Leather Belting Association—Free Hides.

The fifteenth annual meeting of the Leather Belting Association was held in New York last week at the Astor House. Along with other matters relating to the interests of the members, such as an advance in prices, etc., the following resolution was adopted:

"Resolved, that the Leather Belting Manufacturers' Association respectfully petitions Congress to restore hides to the free list, and urges upon the legislators the necessity of prompt action in this matter for the great benefit to be derived in building up a foreign trade in the leather belting industry.

Steps were taken to see that this resolution is properly placed before the President, the members of the Cabinet and members of the Ways and Means Committee; also members of Congress generally.

The following officers were elected for

the ensuing year: President, Edward P. Alexander, Philadelphia; vice-president, Edward H. Ball, Chicago; secretary and treasurer, George H. Blake, New York. The executive committee chosen is as follows: Chas. H. Schieren (chairman), Edward R. Ladew, Frank B. Williams, R. H. Bickford and Robert N. Hatherway.

A Union Engineering Society House.

The August 22 issue of the "American Machinist" discusses editorially the subject of a Union Engineering Society House, to be located in New York city, and strongly advocates the consolidation of all of the leading national engineering societies, so far as the establishing of a common home is concerned.

For some time thoughtful members of these various societies have felt that supporting four or five different society houses imposed upon each society an expense which by proper arrangement between the societies could be materially reduced, and we are glad to see the idea take actual form.

There is no reason at all why the suggestion outlined in the editorial cannot be carried out. The plan is eminently feasible and is in line with the general business method of the day. The various libraries could be separately marked and shelved so as to remain distinct if this was desirable or could be combined and cataloged under one system. Various rooms could be reserved for the exclusive use of the separate societies, and scheduled meetings could be arranged so that the large auditorium would be in use practically every night. Hotel accommodations could be provided with the probability of their being used regularly, and the fact that there was something going on at the Union House every evening would tend to draw a large number who now remain away from the society houses because they are rather lonely and uninteresting.

A printing office might be organized for the publication of all current matter, reports and notices, although the annual publications might, as now, be published by contract.

It would seem that such a Union Society House would become a sort of club, where the large number of engineers in and about New York and the many who are visiting here at all times would find congenial company.

We feel that the plan suggested is in the right direction and trust that it will receive the support that it deserves.—"Compressed Air."

The "Technolexicon."

The gentleman who has undertaken the work of compiling a trilingual technical dictionary, of which mention has been made in these columns several times, writes us that as an aid in his work he desires catalogs of industrial establishments of all kinds. This is a work which is to be unreservedly commended, and we have no doubt that many of our advertisers will be glad to forward one of their catalogs. The proper address is: Dr. Hubert Jansen, Dorotheenstrasse 49, Berlin (N. W. 7), Germany.

At Attack Upon Consul General Mason.

"You're another" has long been a favorite method of replying to criticisms where no other reply suggested itself, and this old custom is brought to mind by the treatment being given United States Consul-General Frank H. Mason of Berlin, upon whom a German paper, the "Kreuz Zeitung," makes a savage attack because Mr. Mason simply states a fact regarding the uncertainty of the tariff legislation that is likely to take place in Germany and its effect in withholding or postponing the return of business prosperity in that country. Mr. Mason is of course not the only one who perceives that the uncertainty of this point tends to delay the return of business activity. It is recognized and has been commented upon by others who do business in Germany and is an obvious fact. It is no reply to this fact nor any justification for a personal attack upon Mr. Mason to say that there is also more or less uncertainty regarding tariff matters in the United States. That is another fact which does not at all do away with or controvert the facts stated by Mr. Mason, who has done American manufacturers and others a valuable service by his faithful attention to his duties and by the publication of straightforward, unbiased and intelligent accounts of what has been going on in Germany in commercial circles. In doing this he has also rendered a valuable service to German manufacturers and business men as well, because what he has done has tended to remove apparent causes for misunderstandings.

Lack of employment for those who are competent and who desire to perform useful labor is by no means so rare in America as to render us incapable of appreciating the feelings of our brothers in Germany who in increasing numbers find it impossible to secure employment by which they can earn things necessary to sustain life. Every true American will join in the hope that industrial conditions there will soon improve. It is estimated that there are 35,000 unemployed persons in Berlin and from all over the Empire come reports of people vainly seeking employment.

The voting machine again demonstrated its great value in the recent elections, it being used to some extent, for the first time, in the city of New York, where, as machinists would naturally expect, it did as well as it had previously done elsewhere.

We are again hearing of a wonderful new gun, which, along with its other remarkable qualities, shows an "entire absence of recoil." We believe the story about the $6,000,000 plant to manufacture these guns and all things else that are said about it, but our belief in these things would be strengthened if only they would leave out that stuff about the recoil. No gun can be made that will have no recoil.

Lehigh University is erecting a stone laboratory, 90x43 feet, to be used in connection with the steam engineering work of the course in mechanical engineering. Next fall the university will offer a new and extended course in electro-metallurgy —the first of its kind, it is believed, to be established in this country.

The entire series of reciprocity treaties and agreements made by the United States since 1850 and the pending unratified treaties from which the injunction of secrecy has been removed are published in full in the September "Summary of Commerce & Finance," recently issued by the Bureau of Statistics, Treasury Department, Washington, D. C.

The latest addition to technical journalism is called "The American Blacksmith," which may be fairly described as being considerably like the "American Machinist" in style and make-up. It deals exclusively with matters pertaining to the blacksmith shop and blacksmith work, and is a very creditable initial issue. It is published by the American Blacksmith Company, Buffalo, N. Y.

Last week we gave a brief account of the plans for the American Exhibition which is to be held, May to September next, in the Crystal Palace, London. We have since received information that the Commissioner for the United States is Alfred H. Post and that plans and particulars of space may be obtained from Alfred H. Post & Co., Produce Exchange, New York.

Commercial Review.

NEW YORK, Monday, Nov. 18.

TOOL MARKET AND OTHER NOTES.

At no other time during the year does business in the machine-tool line appear to have been more uniformly active than it is to-day. While the closing of any especial large deals is generally negatived at the selling offices, assent to the general activity of trade is well-nigh universally met with. One house has more than it can conveniently handle and is looking forward to the best few months' trade on record. Railroad work is active, particularly in the West. Western roads indeed are considered to be usually more progressive in the matter of shop equipment than are the Eastern. There is stated to be a

good demand for tools from companies who are builders of tools themselves as well as from manufacturers of other kinds of machinery—thread-making, for instance. Although machine-tool manufacturers and dealers are so considerably pressed with contracts, however, none of them have yet succumbed to the fate of a New York tradesman in another line who last week committed suicide by inhaling gas and whose death is ascribed to the fact that he had more orders than he could fill.

As an anomaly of trade, a certain manufacturer has made an important reduction in the price of a standard line of tools. In another part of the country a type of tool closely related to this has been on the advance at a comparatively recent date. If any lesson is to be drawn from the reduction referred to, it is simply that in shaky days the trade ought not to take alarm too soon when prices are reported for they are liable to occur in the best of times. The implication that the present are "the best of times" is made advisedly, for while there is not the noisy onslaught of business that there was in 1899, the silent activity of 1901 is more wholesome and satisfactory.

Bids were opened, November 12, by the Army Chief of Ordnance for furnishing seven 12-inch disappearing gun carriages. The lowest bid and shortest time for delivery was named by the Midvale Steel Company as follows: Four carriages, $42,500 each; 7 carriages, $40,709 each; first carriage in 180 days and one every 40 days thereafter.

The American Turret Lathe Company appears to have settled definitely upon Warren, Pa., for its new plant. The plans that are under way provide for the following buildings: Erecting shop, 60x300 feet; fitting room, 30x150; storeroom, 30x210; wash room, 30x90; machine shop, 150x210; power house, 30x60; forge shop, 30x60; office and drawing room, 30x90; pattern shop, 30x60; tool room, 30x150—a total of about 75,000 square feet. The buildings will be of steel and brick construction with cement floors and saw-tooth slag roofs. The equipment will comprise more than 125 machine tools. Several special machines of original design will be built in the company's works for its own use. The plans call for five- and ten-ton electric traveling cranes, light jib cranes, pneumatic hoists, narrow-gage industrial railways, etc. In the power house will be two gas engines, driving electric generators. The distribution will be electric, the larger tools having individual motors. All of the belt-driven tools will be supplied with a new variable speed countershaft invented by Mr. Conradson. The forge shop will be supplied with annealing and case-hardening furnaces, hammers, etc. All of the furnaces will be operated by natural gas. The construction of the foundry will be postponed till the machine shop is in working order.

The Leather Belting Association met in the Astor House, New York, November 12, and decided to adopt a new list of prices, making a material advance. This increase, it is estimated, amounts to 20 per cent. At the same meeting a resolution was adopted advocating the removal of the duty on hides, which is published in another column.

The Diamond Rubber Company, Akron, Ohio, has received from John M. Moulton & Co., Chicago, a contract for more than 60,000 pounds of belting for the big grain elevator that is to be built for the New York Central railroad system at Weehawken, N. J. The rubber company is at present building a factory in Liverpool, Ohio, and is understood to be reaching out after foreign business.

The locomotive building companies are reported to be enjoying the greatest boom in their history. All the leading roads are short of locomotives. Last week the American Locomotive Company received orders amounting to $3,806,000. The Baldwin Locomotive Works are turning out five engines a day, against four last year. Their output in October aggregated 134. The October output of the American Locomotive Company amounted to 167. The New York, New Haven & Hartford has ordered thirty locomotives, the Chicago Great Western forty-five, the Chicago & Northwestern twenty-five, the Great Northern twenty-five, and the Atchison twenty. The Baltimore & Ohio Railroad is to place orders for fifty locomotives, thirty-eight passenger equipment cars and 6,000 freight equipment cars. The cost will approximate $7,000,000.

The Bullock Electric Manufacturing Company, Cincinnati, is contemplating enlarging its works and building electric machinery of the biggest size.

There is a report that the General Electric Company is to establish works at Mechanicsville, N. Y., but it is discredited.

Boyts, Porter & Co., Connellsville, Pa., have made a shipment of a large steam pump to the Hecla Coke Company. It is 30 feet in length and 10 feet high, and weighs 17 tons. The water end is built entirely of bronze. This is the sixth pump of the size furnished the Hecla company.

The Filer & Stowell Company, builders of engines, etc., of Milwaukee, are stated never to have enjoyed in the history of the concern so much large and important work on hand as at present. The company is now putting up a 260x100-foot addition to the machine shops, and when that is done will build a 350x100-foot addition to the erecting shop and a 350x220-foot addition to the foundry.

We mentioned last week the projected construction of a big new shipbuilding plant at Norfolk, Va. There is also an enterprise of the same nature on the Gulf coast. The company, which is to be known as the Gulf Coast Shipbuilding and Dry Dock Company, has been incorporated under the laws of Alabama by a special charter, permitting it, among other things, to construct and operate a shipbuilding and marine railway plant on the Bay of Mobile and a dry dock and ship-repairing plant at the port of New Orleans. The company is governed by New York and Southern capitalists, Charles M. Jesup, of New York, being president. It is capitalized at $5,000,000, and contemplates an issue of $4,000,000 bonds. The Finance Realty Trust Company of New York is to finance the new corporation. It is pointed out that the company has in view the conditions that will result from the construction of an Isthmian canal.

FOREIGN NOTES.

An English tool dealer who returned home a few days ago after an American trip left behind a good report of the English market for tools in special lines. During the year pretty large sales have been made. The automobile as well as the electrical line is for the time being one of the chief supports of the market.

A machine-tool building concern in this neighborhood speaks of a very fair and improved trade in England. It has on hand at present two good inquiries for machine-shop equipment.

A prominent German manufacturer is quoted in a despatch as expressing a belief that the United States in ten or fifteen years will supply all Mediterranean countries, including Austria, with coal and iron. Even tariffs in his opinion will not be sufficient to prevent the flooding of European markets with American products.

It is stated in a local tool establishment which is in fairly close touch with German affairs that American-built machine tools which have been exported to Germany are being offered for reshipment at sufficient reductions of price to cover the freight both ways.

The British Westinghouse Electric and Manufacturing Company is shortly to issue 250,000 pounds sterling of preferred shares to provide additional funds to be used in completion of the company's new buildings and the purchase of machinery.

The British Thomson-Houston plant, while not entirely completed, has already begun to turn out work. For this plant, like that of the British Westinghouse Company, a large quantity of American equipment has been secured.

We mentioned several months ago that the J. G. Brill Company, of Philadelphia, car builders, were contemplating the establishment of a British plant. G. Martin Brill, the president, has just gotten home from England, where he has been looking over the field. The matter has not yet been finally passed upon by the board of managers. Four sites are under consideration—Manchester, Preston, Gloucester, and Glasgow, the first mentioned being given rather the preference. A reason for establishing this branch is to save the excessive ocean freights on cars built for Europe. Against this, however, must be reckoned a possibly greater cost of pro-

duction. Mr. Brill found that while labor was cheaper than here, the amount of work accomplished by the Englishmen was far below that of the American workman. Besides, local freight rates were higher in England. If this plant is started, American material will be used as far as practicable.

The Austrian Government is adopting practical means to help tide the native machine tool manufacturers over their depression. The following we translate from a circular addressed by the Railway Minister to the management of the private railways of the country:

"A deputation of representatives of the domestic machine-tool manufacturers has, in reference to the recently perceived lack of orders and the regrettable reduction of work resulting therefrom, petitioned the government to help avert the threatened destitution in this young and promising branch of industry through the earliest possible procurement of orders.

"A similar call for help has come to the knowledge of the national government from the bridge works as well as the car factories, which industries raise a general complaint of insufficient business and impending further curtailment of work.

"In view of important public interests which appear to be concerned with the state of affairs described, as much as possible is being done on the part of the government railway management to give out with all possible haste contracts and orders for the near future pertaining to these branches of industry. Moreover a few private railroad managements, in particular that of the privileged Kaiser-Ferdinands-Nordbahn, have with gratifying celerity ordered large quantities of supplies. It appears to me, however, urgently necessary that the preparations for similar orders contemplated by the honorable managements of other private railways—for instance, contracts had in view for supply of machine tools and other workshop equipment, as well as bridge and station material and cars—be carried through with all possible speed, and I suggest attention to placing the orders as soon as may be.

"For this purpose, not only present needs, but also those of the next few years, ought to be considered, and I should be especially grateful if the branches of domestic manufacture named—particularly machine tool, bridge and car building—should in this way secure a good volume of orders."

A new gas holder of the Auckland (New Zealand) Gas Company was recently dedicated. This holder has a capacity of 1,100,000 feet. The makers were R. D. Wood & Co., of America, and it was erected under their supervision, local men being employed in the actual work. In the course of an article called forth by the occasion, the "New Zealand Herald" states as follows: "It was originally intended to purchase the holder in England, but the company found they could be better served in America, another illustration of the necessity for British manufacturers laying themselves out for securing colonial trade by adopting the latest labor-saving appliances, and thus catering on equal terms with the Americans."

It is intimated that the report of the Philippine Commission just received repeats the recommendations for the establishment of a system of coinage for the archipelago. Manufacturers of minting machinery will do well therefore to be on the lookout for the equipment of a Philippine mint.

STEEL TRUST MATTERS.

The formation of a new steel trust comprising companies outside of the United States Corporation is agitated, and we have fairly trustworthy information that it is going through. Aside from one rather important company which seems to be going in, its membership is a matter of doubt, as also whether it will be a steel plate trust simply or will embrace nearly all of the "outside" concerns. It would be a surprise if Jones & Laughlins could be induced to join.

Owing to the move of the United States Steel Corporation in opening a bureau of mines and mining in Pittsburgh, it is believed in Wall Street that the company is going to develop its coal-mining properties on a large scale.

CHICAGO MACHINERY MARKET.

There is more than the usual divergence of opinion regarding the engine and boiler trade during the past month. Some makers report an undiminished business; others say there is a falling off. On the whole, November is not showing up with the same activity that prevailed throughout October, a month of blessed memory. For this tapering trade there is good and sufficient reason. In October there was considerable buying of power for spring delivery to be placed on foundations laid this fall. Sizes, types and all details had to be arranged before the foundation work progressed and accordingly the boilers and engines were bought. But it is now getting late for additional foundation work and that class of trade is rapidly disappearing. An occasional order appears for quick delivery, but there is usually something of the emergency nature about it.

But business of some magnitude is already under way for next spring and summer delivery. Thus Wickes Brothers say they have several thousand horse-power in boilers placed for shipment next May and June. It does not consist of several large orders, but a fairly large number of small and medium-sized purchases, and hence a more satisfactory criterion of next year's probable requirements. The Babcock & Wilcox Company is reported to show little or no decrease this month, and with rare exceptions the business now is for next season's deliveries. There are said to be many inquiries pending, some of them for large installations, but there is more than the usual or recent delay in closing them, for the necessity for haste seems to have disappeared. Manufacturers continue to increase and improve their manufacturing facilities. Thus, A. L. Ide & Sons have not only increased their shop capacity but have just organized a night force of workmen, taking considerable pains to arrange for its permanence.

The St. Louis Portland Cement Company, St. Louis, Mo., has recently purchased a power outfit, buying boilers of 1,600 horse-power from the Heine Safety Boiler Company and engines of corresponding power from the Hamilton Corliss Engine Company.

Among orders recently placed by the Allis-Chalmers Company are the following: Wright Shovel Company, Anderson, Ind., one 400 horse-power engine; Fonda, Johnstown & Gloversville Railway Company, Gloversville, N. Y., three 1,800 horse-power vertical cross-compound engines; Henderson Cotton Company, Henderson, Ky., one 400 horse-power; Empire State M. & D. Company, Wardner, Idaho, one 125 horse-power engine; one 18 and 32x42 inch cross-compound direct connected engine for W. S. Stratton, Colorado Springs, Col.; two pumping engines for the Niagara Falls Power Company, etc.

The Erie City Iron Works have sold 1,000 horse-power water-tube boilers for the Minnesota State Capitol and are about to install water-tube boilers of 4,500 horse-power for the Kokomo Steel & Wire Company, Kokomo, Ind.

Quotations.

NEW YORK, Monday, Nov. 18.

Pennsylvania Foundry Pig Irons, Jersey City delivery:

No. 1 X	$15 65	@ $17 50
No. 2 X	15 15	@ 15 65
No. 2 plain	14 65	@ 14 75
Gray forge	14 25	@ 14 50

Alabama Pig, New York delivery:

No. 1 foundry, or soft	$15 75	@ 16 00
No. 2 foundry, or soft	15 25	@ 15 50
No. 3 foundry	14 75	@ 15 00
Foundry forge, or No. 4	14 25	@ 14 50

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots. From store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c.

Copper—Lake Superior ingot, spot, 16¾ @ 17c.; electrolytic, 16½ @ 16⅝c.; casting, 16 @ 16¼c.

Pig Tin—In 5 and 10-ton lots f. o. b., New York, about 27c.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.30c., New York delivery.

Antimony—Hallett's, 8¼ @ 8⅜c.; Italian, 7¾ @ 8c.

Lard Oil—Prime City, 70 @ 73c., in wholesale lots.

Making Steam Engine Connecting Rods on the Milling Machine.

I have recently had occasion to look into some of the present methods of steam-engine manufacture, and one of the things that attracted my attention particularly is the amount of time that is consumed in making connecting rods, especially when they are of the solid end pattern. These rods are usually made of machinery steel, either from special forgings or out of commercial bars. The most difficult and most expensive job about the rod is that of working out the holes in the ends into which the brasses are fitted. When one considers the advancement that has gone on along other lines of manufacture, it seems strange that the great expense of the present method has not driven someone to improve on the old way of finishing these holes, but, so far as I know, the accepted method in use to-day is still the old way of drilling out the metal to be removed and then finishing the hole to size on a slotting or shaping machine. This usually leaves the hole in such condition that considerable fitting is necessary before the brasses are finally set in place.

All who are vitally interested in making these connecting rods are naturally very anxious to follow a different method, and a discussion of the possibilities of an improvement led to the suggestion that it might be possible to do it on a milling machine. Following this suggestion, we decided to do away with the series of drilled holes, and, instead, drill a single hole in one corner of the rectangular section of metal to be removed; and use this one hole as a starting point from which to finish the hole for the brasses at one operation. The chief difficulty in the way was that the drilled hole, and consequently the cutter, had to be extremely small in diameter in order to work close into the corners, this being necessary in order to give the brasses sufficient bearing.

The case chosen was that of a connecting rod 2 inches thick, having a hole for brasses 3x6 inches, with corners of ½ inch radius. The first problem considered was that of obtaining a milling cutter 1 inch in diameter, with flutes of sufficient length, which would be strong enough to stand up under the strain, and which would also free itself of chips. At the left of the photograph is shown the cutter which we designed and used with good success.

The cutter is, in form, a tool-steel milling machine arbor with cutting edges or flutes on part of its length. The end of the taper shank is tapped ⅝"-11, so it can be drawn in by means of a bolt passing through the hole in the spindle. The outer end beyond the flutes is finished cylindrical and ground to size to fit the support from overarm the same as an arbor. The cutter has *four* flutes, and consequently the space for chips between the flutes is large. The cutting edges of the flutes are nicked to break up the chips. The flutes form a *right* hand spiral with an angle of 19° 20′, which is about double the angle of the usual milling cutter of the same size. It was made in this way so that the chips would be carried out by the cutter in a manner similar to that in which a twist drill clears itself of cuttings.

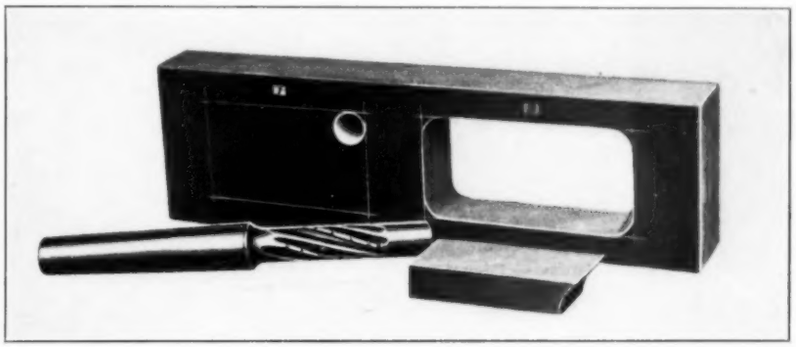
We selected for our experiment a 40-carbon 2x5-inch hammered machinery steel bar. A 1-inch hole was drilled through the bar, at one corner of the rectangular section of metal to be removed, as shown at No. 1 in the photograph. The work was then clamped to the table of a No. 3 plain "Cincinnati" milling machine (one of those machines with a geared feed mechanism) in such a manner as to bring the drilled hole in line with the spindle. The cutter, having been previously secured in the spindle, was passed through the hole and the outer end properly placed in its bearing in the support from the overarm.

The machine was first fed to the right, then up, then left, and finally down to the starting point. The result was a rough rectangular hole in the bar, a large pile of chips and a core, which is shown in the photograph, immediately in front of the hole. The cutter was working at 78 revolutions, which is a surface speed of approximately 20 feet per minute and the machine was feeding 0.006 inch per revolution, *i. e.*, 0.468 inch per minute. The strain on the cutter was very great. A stream of oil ¼ inch in diameter was delivered to the cutter, with sufficient pressure to keep it entirely free of chips.

It must be borne in mind that the arc of contact of the cutter was 180 degrees and the chips got to be pretty large before they were finished. It would have been impossible to keep the cutter clear if the teeth had not been nicked, so as to break the chips up into short lengths. When the first cut was completed a cut 0.020 inch deep was made to finish the hole. This operation was a repetition of the first except that the rate of feed was changed to 0.025 inch per revolution of cutter or 1.950 inch per minute.

The total time consumed from the moment the first cut was started until the finishing cut was completed was 42½ minutes. It takes between four and five hours to do the same work by the present method. The finished hole has sides so nearly parallel that no variation can be detected with the micrometer. No attempt was made to finish the hole to a given size since that had nothing to do with the experiment, which consisted entirely of determining whether such a hole can be made with these tools and the length of time it would take to do it. An operator would lose considerable time in making the first hole to size, while experience on other operations shows that after some practice he would be able to come very close to the time given in the experiment. The ease with which this job was done and the accuracy of the finished hole have convinced everyone who has seen it of the practicability of the method used, and one engine builder is now getting ready to follow this method in finishing his connecting rods, some of which are 4 inches thick.

The above experiment covers only one of quite a number of milling operations that have recently come to my notice, all of which are illustrative of the wide applicability and superiority of the milling machine in a great many cases where the older tools are still being used.



A JOB OF MILLING AND THE CUTTER.

In conclusion it is only fair to say a word for the milling machine used in the experiment. Anyone who harbors a doubt about the need of a positive feed mechanism on a milling machine would have had that doubt dispelled had he been present during the half hour when this machine was working on the first cut through the solid metal. The rate at which the machine was fed was limited only by the pulling power of the main driving belt. After one has gone through the discouraging experience of slipping feed belts, there is considerable satisfaction in getting hold of a machine that has no feed belt to slip. Also, the convenience with which we could bring about the changes in the direction of motion of the table, the change from one rate of feed to another and the ease with which we could start and stop the motion of the table were an important factor in the success of the experiment. To traverse the rectangle once involved four changes in direction and two complete reversals of motion of the machine, all of which had to be done in

the corners, and consequently it was necessary to accomplish the act of making these changes as nearly instantaneously as possible. This explanation is deemed necessary because the experiment was as much a test on the machine as it was a trial of the method. The two are inseparable so far as the data given in this article are concerned. The cutter used was made by the Cincinnati Milling Machine Company.

CHAS. S. GINGRICH.

Cincinnati, Ohio.

Spiral Gears—II.

BY F. A. HALSEY.

THE PRELIMINARY SOLUTION.

The simple formula for the speed given at the conclusion of the last article will be needed repeatedly, and had best be put in algebraic form.

Let r_1 = revolutions of driver,
r_2 = revolutions of follower,
d_1 = diameter of driver,
d_2 = diameter of follower,
α = helix angle of driver.

Then this formula becomes:

$$\frac{r_2}{r_1} = \frac{d_1}{d_2} \tan.\ \alpha \qquad (1)$$

In any actual case the speeds are given and the diameters and helix angle must be found. We may assume a ratio for the diameters and find the angle, or we may assume an angle and find the ratio of diameters. It is desirable to assume the angle first, as on it depends, largely, the durability of the gears. To do this the above formula may be more conveniently written:

$$\frac{d_2}{d_1} = \frac{r_1}{r_2} \tan.\ \alpha \qquad (2)$$

The sum of the diameters must equal twice the center distance, which we may call C. That is:

$$d_1 + d_2 = 2C,$$

or

$$d_2 = 2C - d_1.$$

Substituting this value for d_2 in (2) we obtain:

$$\frac{2C - d_1}{d_1} = \frac{r_1}{r_2} \tan.\ \alpha$$

which, solved for d_1, becomes:

$$d_1 = \frac{2C}{\frac{r_1}{r_2} \tan.\ \alpha + 1} \qquad (3)$$

Having assumed a value for α and substituted its tangent and the ratio of the desired speeds in (3), we find a value for d_1, and, having found d_1, d_2 may obviously be found by subtracting d_1 from $2C$.

Such a solution is complete in a geometrical sense, and if it were feasible to make a cutter to suit each case, it would be complete in a practical sense also. When, however, we go a step further and find the length of the normal helixes, the probabilities are all against their being exact multiples of the pitch of any stock cutter. The solution so obtained must therefore be considered as provisional and be modified to suit the cutters to be used. When the adjustment to suit the cutters has been made, it is still a matter of chance if the resulting angle can be cut with the gears supplied with the spiral head of a universal milling machine, and again the probabilities are against it. Eventually one of these conditions can always be met exactly, but both of them rarely. If both are to be met exactly or with close accuracy, it is frequently necessary to make new gears for the spiral head.

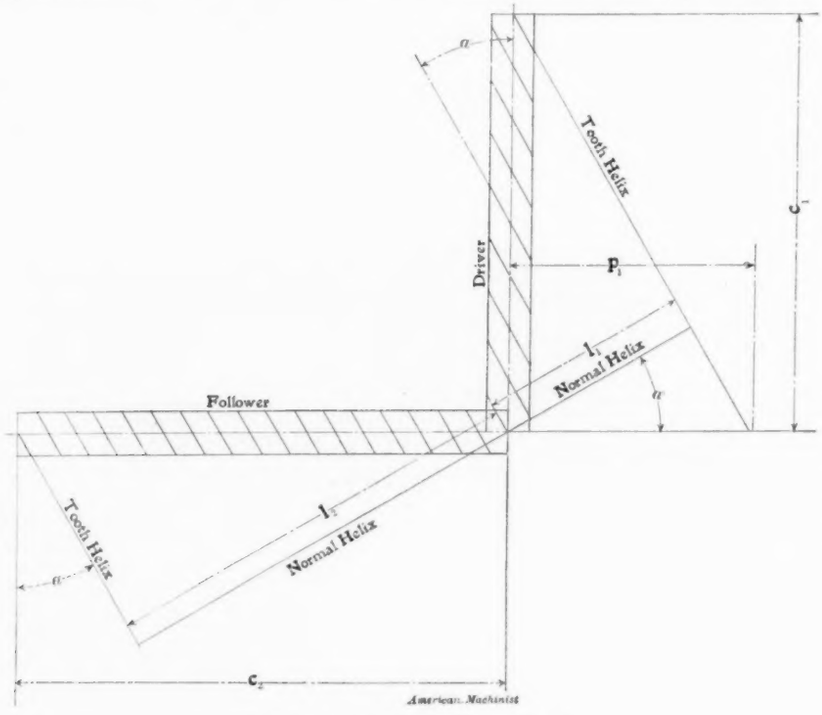


FIG. 9. A PAIR OF GEARS DEVELOPED.

THE LENGTHS OF THE NORMAL HELIXES.

Fig. 9 is the development of a pair of gears placed in the most convenient position for showing the lengths of the normal helixes. The tooth and normal helixes are extended beyond the face of the gears. Let

c_1 = circumference of driver,
c_2 = circumference of follower,
d_1 = diameter of driver,
d_2 = diameter of follower,
l_1 = length of normal helix of driver between intersections with tooth helix,
l_2 = length of normal helix of follower between intersections with tooth helix,
α = tooth helix angle of driver.

Obviously

$$l_1 = c_1 \sin.\ \alpha,$$
$$= \pi d_1 \sin.\ \alpha,$$

or

$$\frac{l_1}{\pi} = d_1 \sin.\ \alpha \qquad (4)$$

$$l_2 = c_2 \cos.\ \alpha,$$
$$= \pi d_2 \cos.\ \alpha,$$

or

$$\frac{l_2}{\pi} = d_2 \cos.\ \alpha \qquad (5)$$

Note that (4) and (5) give the lengths of the normal helixes divided by π and not their actual lengths. This is done because, in dealing with diametral pitch cutters the calculations are made less laborious. Dividing (4) by (5) gives:

$$\frac{l_1}{l_2} = \frac{d_1 \sin.\ \alpha}{d_2 \cos.\ \alpha}$$
$$= \frac{d_1}{d_2} \tan.\ \alpha \qquad (6)$$

Comparing (1) with (6) proves what is almost self-evident, that the lengths of the normal helixes are to each other inversely as the number of revolutions, and hence that *a pitch which will exactly divide the short helix will also divide the long one* and that *the numbers of teeth in the gears are inversely as the speeds.*

A PRACTICAL EXAMPLE.

An example will best illustrate the actual procedure and for this the one given by Mr. De Leeuw in issue No. 2 of last year will answer as well as any. In that example:

$$\frac{\text{revolutions of follower}}{\text{revolutions of driver}} = \frac{r_2}{r_1} = \tfrac{1}{4}$$

and

$$\text{center distance} = C = 4\tfrac{15}{32}$$
$$= 4.468 \text{ inches.}$$

Mr. De Leeuw could not use a helix angle of 45 degrees because it led to a diameter for the driver which was too small for its shaft. We are, at the start, entirely at sea regarding the whole matter; but as an angle of 30 degrees is favorable to durability we may use it as a trial angle and see what it will lead to. Finding the tangent of 30 degrees in a table and substituting it and the value of $\frac{r_1}{r_2}$ in (3) we obtain:

$$d_1 = \frac{2 \times 4.468}{4 \times .57735 + 1}$$
$$= 2.7$$

and

$$d_2 = 2 \times 4.468 - 2.7$$
$$= 6.236.$$

From (4) we find

$$\frac{l_1}{\pi} = 2.7 \times .5$$
$$= 1.35$$

and from (5)

$$\frac{l_2}{\pi} = 6.236 \times .866$$
$$= 5.4.$$

These values of d_1, d_2, $\frac{l_1}{\pi}$, and $\frac{l_2}{\pi}$ are the provisional values belonging with 30 degrees for α.

Mr. De Leeuw desired to use 6 pitch cutters, the circumferential pitch of which is $\frac{\pi}{6} = .5236$. We may find the number of teeth which the normal helixes will contain by dividing their lengths by this circumferential pitch, but

$$l \div \frac{\pi}{6} = \frac{l}{\pi} \times 6.$$

That is, the number of teeth of 6 diametral pitch which the provisional normal helixes will contain may be found by multiplying $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ respectively by 6. Performing this operation we obtain:

$$\frac{l_1}{\pi} \times 6 = 1.35 \times 6$$
$$= 8.1$$

and

$$\frac{l_2}{\pi} \times 6 = 5.4 \times 6$$
$$= 32.4.$$

The provisional normal helixes thus contain 8.1 and 32.4 teeth of the desired pitch, and as these numbers are impossible, we take the nearest whole numbers having the desired ratio of 1 to 4, namely, 8 and 32. That is, we decide to shorten the normal helixes until they contain exactly 8 and 32 teeth.

The meaning of this is shown graphically in Fig. 10. Laying down $a\,b$ and $a\,c$ to represent the circumferences as found above and drawing the normal helixes at an angle of 30 degrees, we have found that the normal helix $a\,d$ of the driver will contain 8 teeth and a little more, and the normal helix $a\,c$ of the follower 32 teeth and a little more. As we cannot have a fraction of a tooth, we decide to cut off the ends of the helixes, making their lengths $a\,d'$ and $a\,e'$.*

FINAL SOLUTION BY CHANGING THE CENTER DISTANCE.

The most obvious way of carrying this out is to simply reduce the diameters of both gears, so as to make their circumferences $a\,b'$ and $a\,c'$ instead of $a\,b$ and $a\,c$. This change obviously reduces the center distance, but at this drawing-board stage of affairs this can often be done, and when it can be done it is the readiest way out of the difficulty. To determine how much to reduce the diameters we must first find the reduced lengths of the normal helixes, which must be such that:

$$\frac{l_1}{\pi} \times 6 = 8$$

or

$$\frac{l_1}{\pi} = \frac{8}{6}$$
$$= 1.333$$

and

$$\frac{l_2}{\pi} \times 6 = 32$$

or

$$\frac{l_2}{\pi} = 5.333.$$

Knowing these corrected values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$, it is easy to find the new diameters. It is apparent from Fig. 10 that the ratio between the provisional and final diameters is the same as that between the lengths of the provisional and final helixes, which latter is 8.1 to 8, or its equal 32.4 to 32. That is:

$$\frac{\text{final diameter}}{\text{provisional diameter}} = \frac{8}{8.1}$$

or

$$\text{final diameter} = \text{provisional diameter} \times \frac{8}{8.1}$$

That is:

$$\text{final } d_1 = 2.7 \times \frac{8}{8.1}$$
$$= 2.667$$

and

$$\text{final } d_2 = 6.236 \times \frac{8}{8.1}$$
$$= 6.159$$

and $d_1 + d_2 = 2.667 + 6.159 = 8.825 =$ twice the new center distance.

GRAPHICAL SOLUTION WITH CHANGED CENTER DISTANCE.

All these determinations may be made graphically as in Fig. 11. Lay off $a\,b = 2\,C = 8\frac{1}{8}$ inches. At any convenient distance lay off the indefinite line $c\,d$ parallel to $a\,b$. At c lay off the provisional angle $\alpha = 30$ degrees. Draw $e\,f$ at any convenient point perpendicular to $c\,d$. Take $e\,f$ in the dividers and step it off from e toward d as many times as will represent the ratio of the desired speed of the driver divided by that of the follower. That is, in the present case, lay off $e\,f$ 4 times above e and thus obtain d. Draw $c\,a$ and $d\,b$ and extend them till they meet at g.* Draw $g\,e$, giving $a\,h$ and $b\,h$, which are provisional diameters of driver and follower respectively. Draw $h\,p$ perpendicular to $a\,b$, at h lay down $h\,k$ and $h\,l$ to repeat α, and from h strike arcs $a\,k$ and $b\,l$. Draw $k\,o$ and $n\,l$ perpendicular to $a\,b$, and we have the provisional values:

$$a\,h = d_1$$
$$b\,h = d_2$$
$$h\,o = \frac{l_1}{\pi}$$
$$h\,n = \frac{l_2}{\pi}$$

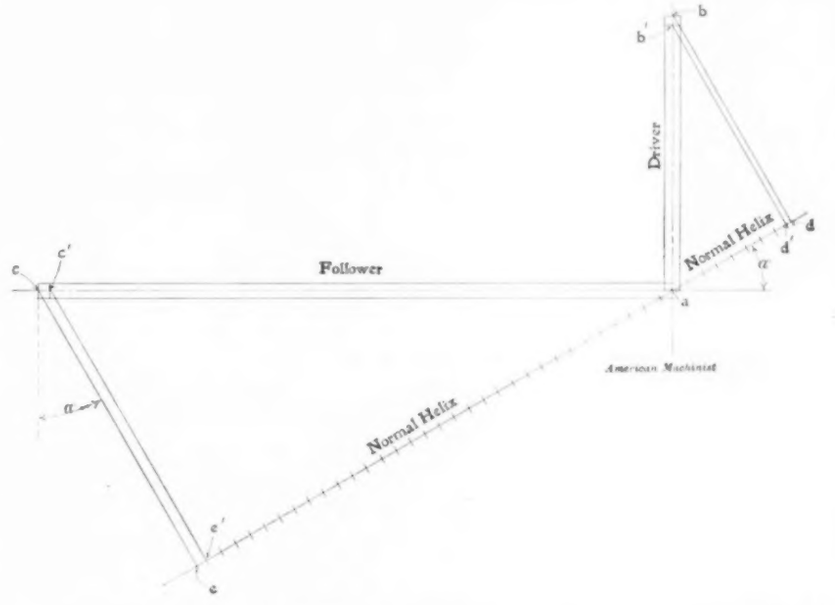


FIG. 10. ADJUSTING THE DIAMETERS WHEN THE CENTER DISTANCE CAN BE CHANGED.

Scale $h\,o$ and $h\,n$ and multiply them by the diametral pitch number — 6. If the results are not whole numbers, as they usually are not, select the nearest whole numbers having the desired speed ratio, and they are the final numbers of teeth. Divide these numbers by the diametral pitch number to obtain the final values of $\frac{l_1}{\pi}$ and $\frac{l_2}{\pi}$ and lay them down as $h\,o'$ and $h\,n'$. Draw $o'\,k'$ and $l'\,n'$ and $k'\,a'$ and $l'\,b'$, giving:

$a'\,h$ = the final d_1,
$b'\,h$ = the final d_2,
$a'\,b'$ = twice the new center distance.

(*Concluded next week.*)

*Should the helixes come out a little short instead of a little long, they would be lengthened instead of shortened. Had the helix of the driver been of a length to contain, say, 8.3 teeth, that of the follower would obviously have contained 33.2 teeth, and, in the correction, more than an entire tooth would have been cut from it.

*Had $c\,d$ been taken shorter than $a\,b$, g would have fallen to the left of the diagram, but the construction would otherwise have been unchanged.

Re-Sharpening Files.

A U. S. patent has recently issued to Frank Rowley, Whaley Bridge, England, for a process for re-sharpening worn-out files. The specification refers to the often attempted process of sharpening files by the action of nitric acid, a previous patent having been taken out by the same inventor in 1893. The specification says:

In carrying out the said method it has been found that notwithstanding a thorough cleansing of the files in soap and soda and rinsing in water the nitric acid in many cases was acting slowly and irregularly in attacking and biting away the bottom and sides of the teeth. The object of my improvement is to render the action of the nitric acid more certain and regular. For this purpose after washing and brushing the files of soap and soda and rinsing them in water, I immerse and pickle them for about half an hour in diluted sulfuric acid, one part of commercial acid being mixed with about four parts of water. The sulfuric acid slightly corrodes or attacks the surface of the file and prepares it for the subsequent action of the nitric acid, imparting a surface to the file which enables the subsequent process to operate more certainly and efficiently and to produce a greater and more uniform sharpness of the tooth than when such preliminary pickling is not applied. With the same object after pickling the files in sulfuric acid, as aforesaid, I also draw the point of a needle through all the grooves of the file, slightly scraping or scratching the surface of the bottom of the grooves, in consequence of which the nitric acid is enabled to act more certainly at this point and bite away the sides of the teeth from the bottom toward the top. After cleaning and drying the files I coat the worn or flat tops of the teeth with varnish, such as Brunswick black, capable of resisting the corrosive action of acids, and immerse them in a mixture of nitric acid and water till the bottom and sides of the teeth are bitten away sufficiently to throw off the flat tops, leaving the newly-formed teeth very sharp.

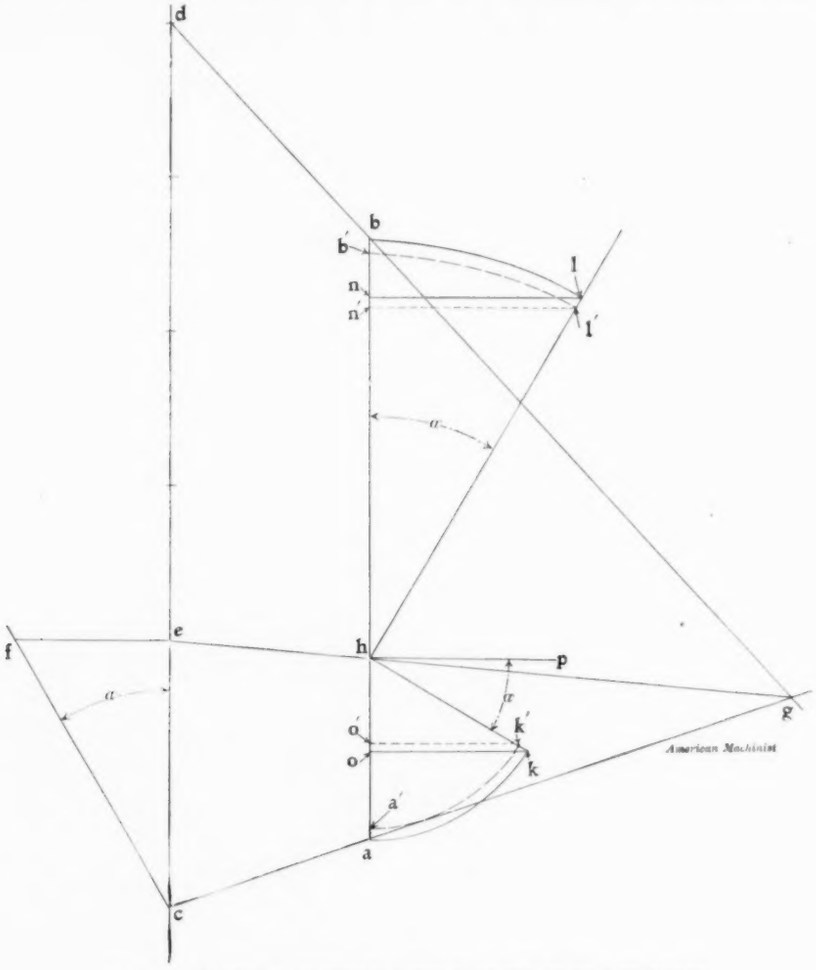


FIG. II. GRAPHICAL SOLUTION WITH VARIABLE CENTER DISTANCE.

Taking the Bull by the Horns.

A certain general manager has developed what seems to us quite a novel way of dealing with the union problem. Shortly after employing a man in his machine shop he received several letters from another town informing him that this man was a very bad specimen, that he was an agitator from agitatortown, that he stimulated the workmen to do all sorts of disagreeable things, was a bad citizen generally and a bad man to have about a shop—a disturbing element, in short. Calling the man into his office he said to him: "I understand that you are an agitator and that you devote a good deal of energy to stirring up dissatisfaction and trouble." "Well," the man said, "I don't know that I have done anything particularly wrong in that line, although I have taken an active part in some labor difficulties." "Well," said the superintendent, "if you can handle men in the way these letters say you can and make them do things that they otherwise would not do, I think you can handle them in this shop if you have a mind to, and I want you to take charge of all the lathe work and see that it is done in good shape and that a full day's work is done. In short, I would like you to be foreman of the lathe department." The man was of course astonished, but he said that he would take hold of it and do the best he could, and this he has been doing ever since; the superintendent being ready to testify that he is a most excellent and most satisfactory foreman in every way. He knows what a day's work is, and requires that it be delievered by every man every day, and the men seem perfectly satisfied to do it for him continuously and uniformly.

Abbreviations and Arbitrary Signs in Working Drawings.

BY GERALD E. FLANAGAN.

It would doubtless be possible to build machines and other structures without the aid of drawings, but such a procedure would involve an enormous increase in the time and effort required to accomplish the desired result. It thus appears that shop drawings are essentially labor-saving devices, and it might be expected that draftsmen would grasp most readily at any suggestion tending to economize their time or improve the quality of their work. Such is generally the case; but, for all that, means which are of more or less universal application are found to be only occasionally employed, and the more extended use of abbreviations is one of these. When first introduced, abbreviations and arbitrary signs appear troublesome, but when well established and understood they save an incalculable amount of labor. Who would think of writing Mister or Mistress, number, pounds or percentage, in place of Mr., Mrs., No., lbs., %. The more generally a given sign is used the more useful it becomes, and a simple mark which replaces a word or sentence is finally recognized with less mental effort than is required to read the words it represents.

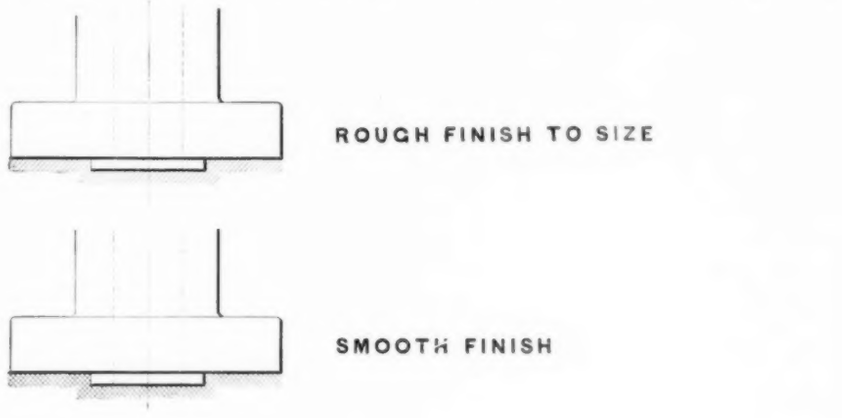
Formerly drawings were very freely decorated with the words bore, turn, plane, machine, etc., to indicate the parts where finish was required, but recently these instructions are given by simply drawing a small letter "f" across the lines on the drawing. Many prefer a heavy red line

along the full length of the part to be machined. This looks well if carefully done, shows faintly blue on the point, and need not in any way be made to confuse the lines of the drawings. It is, however, difficult to remove from the tracing in case a change is required, and for this reason a broken black line is often used instead. Others, again, use a wavy black line produced by using a ruler with a bluntly serrated edge. A method which finds some favor is that of placing a series of short lines forming a fringe against the surface to be finished. This is executed freehand, and requires skill to make it look well. The plain fringe is sometimes used to show rough finish to size, and it is cross-hatched where smooth finish is wanted. Figures with a short, heavy, horizontal line beneath them are understood as being correct, but that the drawing is not to scale in the part to which they refer. A reverse curved line is better for this purpose, as drawing one or more short straight lines beneath a dimension is a good way of indicating that a variation of so many thousandths of an inch less is allowed, while if the lines are placed above the figures it is understood that the work must not measure less than called for, but an increase of so many thousandths will be permitted; while if shown both above and below, the allowed variation either way will be admissable.

Structural steel works make liberal use of signs and abbreviations, and this is one reason why their drawings are very hard to read by one who is not familiar with their meaning; but this is not the only reason, nor even the principal one. These drawings are usually very roughly made, to serve the turn of seeing one particular job through the shop, and are rarely available for use a second time. Not only this, but one set of details bears a strong resemblance to another of the same class, one column or strut differing from a score of others only in some minor dimensions or the presence or absence of some insignificant angle or connection, or, it may be, only in the number or arrangement of some holes for bolts or field rivets. Moreover, one detail is frequently made to do for several different ones, with wordy descriptions of additions to be made to suit the various cases. The signs and marks are, generally speaking, expressive of their own origin. A capital C with a vertical line through it denotes center line; L's, angles; I's, I-beams; pls., plates; G, girt; C, column; T, truss; ⊥'s tees. The double cross sign for pounds seems to be arbitrary, and when placed before the figures instead of following them often signifies number.

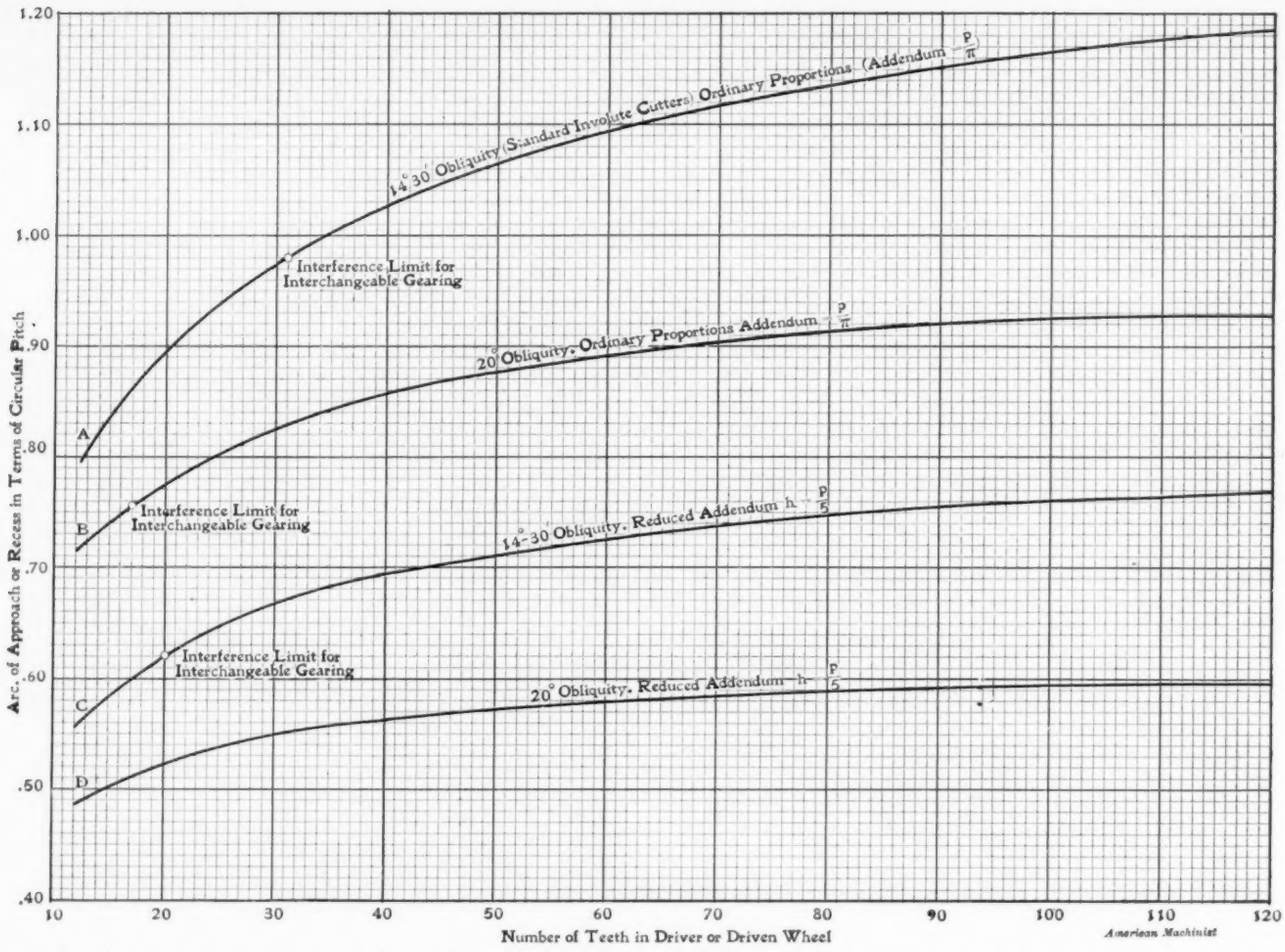
The custom of placing a great many details upon one large sheet has created the necessity for a series of marks by which each one may be distinguished from any of the others. Capital letters are mostly used, and though nothing better has been proposed, they are not all that could be desired for the purpose. The letter I should be ruled out because it is commonly made to look too much like the figure 1, while O and Q have a strong resemblance to each other unless their distinguishing characteristic is very strongly emphasized. N looks like Z when seen sideways, and for this reason the last letter of the alphabet should not be used. The letter O would be better omitted, as in some combinations it might be mistaken for a cypher. These considerations reduce the number of letters available for the purpose; and they were already all too few, as on many sheets the bill of material calls for forty or fifty different details. To meet this condition the alphabet of small letters is sometimes used, but their peculiar forms render them less desirable than the capitals. Sometimes the same letters are used again and distinguished by drawing around them a circle, a square or a triangle; also double and triple letters have been used, but none of these methods appears to give as much satisfaction as combining the second or third alphabet and its respective number, and writing A2, B2, A3, B3, etc. The figures should be made of the same size and importance as the letters they are combined with. The practice of writing A^1, A^2, B_3, in which the figure is so small as to be frequently overlooked, has been productive of many serious errors.

Complicated details requiring numerous sections to illustrate their interior construction have the precise locations of these sections indicated on the plan or elevation by the use of reference letters or figures, and these should be so chosen as to be quite dissimilar to any others used on the same drawing. The Roman numerals are available for this purpose, and are fairly satisfactory. They are frequently drawn with a straight horizontal line touching them both top and bottom, which adds to their formal and distinctive appearance. It is better to write section I I I, section IV IV IV IV, in place of section I II III or section IV V VI VII, as the eye follows the directing line on the drawing much more readily when led by the several repetitions of exactly the same form, than when they exhibit slight variations, and there is nothing gained by numbering the changes of direction, even when the section is taken through many different planes. It also reduces the number of characters required to indicate sections, and this is in itself a decided advantage.


ROUGH FINISH TO SIZE
SMOOTH FINISH
A2, B2 THE RIGHT WAY
A' A² B₃ THE WRONG WAY
℄ = CENTER LINE, L = ANGLES, I = I BEAMS, PLS. = PLATES
G = GIRT, C = COLUMN, T = TRUSS, ⊥ = TEES, 20# = 20 LBS.
SECTION II, II, VV, XX
American Machinist

ABBREVIATIONS FOR WORKING DRAWINGS.

The city of Paris has appointed a committee to study the means, processes and apparatus for suppressing smoke both from industrial establishments and dwellings. Anyone, Frenchman or foreigner, having devices conducive to this worthy end may address M. le Préfet de la Seine (Hotel de Ville, Paris). Submissions should be accompanied with all documents necessary to explain the system, such as descriptions, designs, expense of installation, results of experiments, and practical results.



Arc of contact = arc of approach + arc of recess. To find arc of approach: Trace from number of teeth of driven wheel in lower scale to curve and thence horizontally till arc of approach is found in terms of circular pitch. For arc of recess: Use number of teeth in driver.

FIG. 10. LENGTHS OF ARCS OF APPROACH AND RECESS FOR INVOLUTE TEETH.

Considerations Affecting the Hight of Gear Teeth—II.

BY ROBERT A. BRUCE.

INVOLUTE TEETH.

As in the case of cycloidal teeth, so also with involute teeth whose addendum is of the ordinary proportions, the arc of contact is considerably in excess of the bare requirements. The relationship between the number of teeth in a pair of wheels and the arcs of approach and recess is capable of mathematical expression, and the two upper curves *A* and *B* of Fig. 10 have been worked out in this way, so as to exhibit at a glance the arc of recess and approach for wheels having teeth of obliquities of 14½ and 20 degrees.

On inspection it will be at once seen that the requirements of continuity are more than met and it only remains to see how far it is possible to reduce the addendum.

For this purpose the two lower curves of Fig. 10 have been constructed giving the arcs of recess and approach for teeth of the same obliquity as before, when the addendum is reduced to ⅕*p*. Fig. 11 sufficiently explains the method employed. It will be seen that in the case illustrated

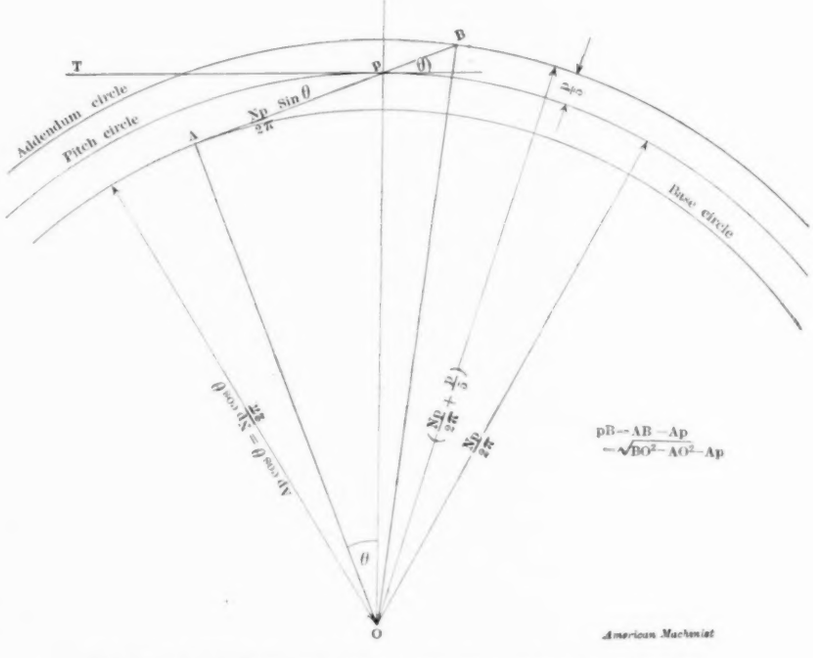


FIG. 11. METHOD OF OBTAINING ARCS OF APPROACH AND RECESS.

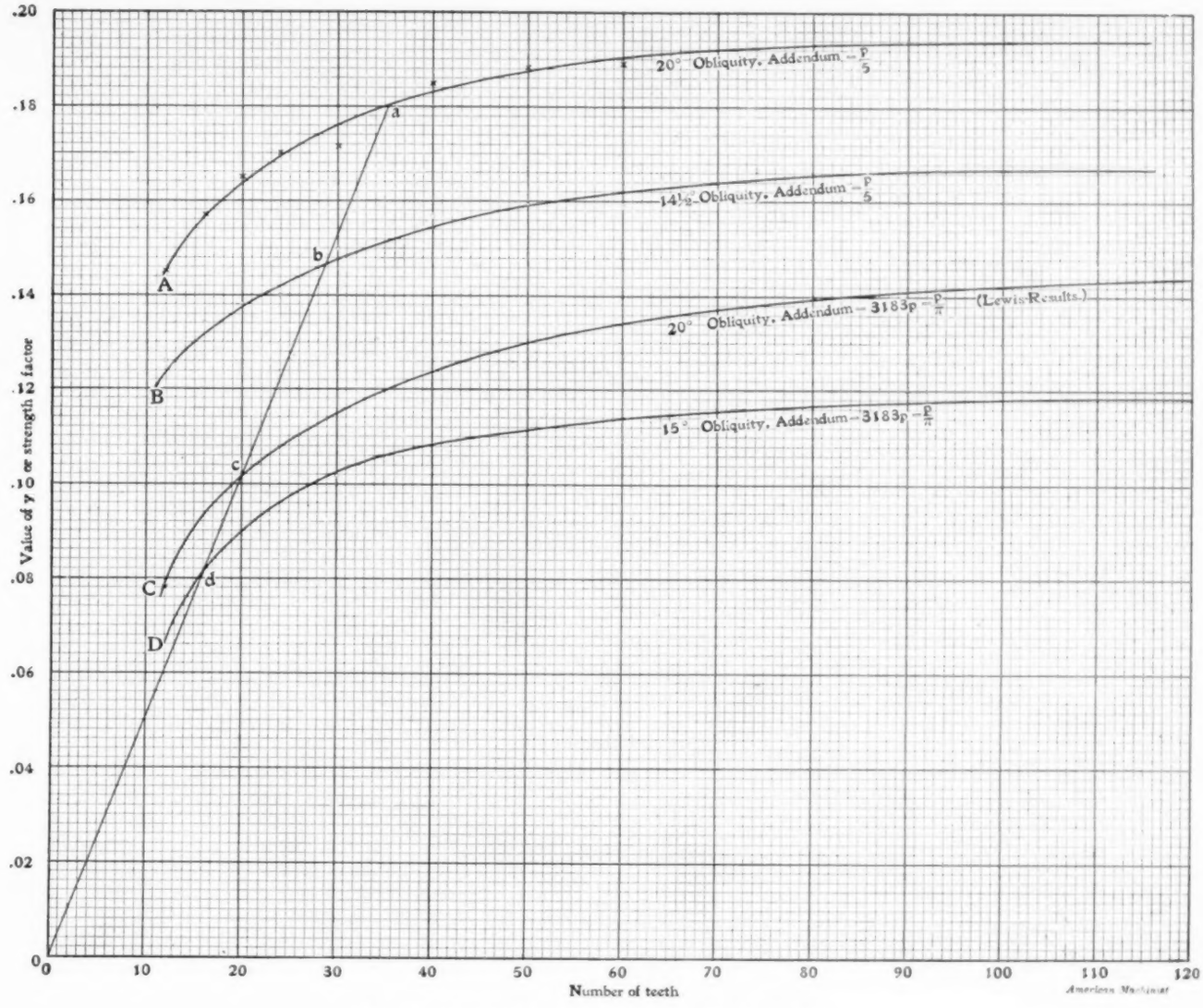


FIG. 12. STRENGTH FACTOR CURVES FOR INVOLUTE TEETH.

the arc of recess is $\frac{pB}{\cos.\theta}$ where pB is found from the consideration that BOA and pOA are right-angled triangles. When the sides are expressed as shown in the figure, the following formula is obtained:

$$a = \frac{n p}{2\pi \cos.\theta} \times \left[\sqrt{\left(1 + \frac{2\pi}{5n}\right)^2 - \cos.^2\theta} - \sin.\theta\right] \quad (3)$$

where a = arc of recess or approach according as n = number of teeth in driving or driven wheel.

It will be seen that though pinions with a low number of teeth are possible with the smaller obliquity, yet with the higher obliquity the arcs of approach and recess are so much diminished that it is inadvisable to use pinions containing less than 20 teeth. A point to be noted in connection with reduced addendum is that the number of teeth can be considerably diminished before it is necessary to allow for interference. Thus, whereas rack interference commences when the number of teeth falls below 31 in the case of ordinary teeth of 14½ degrees obliquity, when the addendum is reduced to ⅕p, it is not felt till the number of teeth falls below 20. Similarly with teeth of 20 degrees obliquity, rack interference is felt when the number of teeth falls short of 17, whereas when the addendum is reduced the minimum number of teeth can be as low as 11 before interference is possible.

The gain in strength due to shortening the teeth can best be estimated by employing a graphical process similar to that explained in connection with cycloidal teeth.

Fig. 12 has been prepared for this purpose. The two lower curves give the values of the strength factors y for obliquities of 15 degrees and 20 degrees, which have been plotted from the table given in Lewis' paper on "The Strength of Gear Teeth." The upper curves give the strength factors for obliquities of 14½ and 20 degrees, the teeth having reduced addenda. The latter curves have been drawn by finding a number of points as shown. The connection between the safe load W (pounds) and the factor y is given by the equation:

$$W = f\, m\, p\, y \quad (4)$$

in which

f = breadth of face,

p = circular pitch,

$m = 8000 \left(\frac{600}{v' - 600}\right)$ for cast iron, where

v = pitch line speed in feet per minute.

As stated in connection with cycloidal teeth, the only fair comparison which can be made between differing systems of transmission by gearing, requires that the load, pitch line speed and dimensions of pitch surface should be kept constant. The pitch and the number of teeth only enter into the question owing to the necessity of fulfilling the requirements as to strength, so that if the pitch is reduced as far as possible consistent with strength it is possible with the shorter teeth to avoid the use of pinions with very low numbers of teeth.

Wheels whose pitch surfaces are of the same diameter and breadth, and which run at the same pitch line load and speed,

may be termed "equivalent wheels," since they perform equivalent functions. Given a wheel with teeth on any system, the strength factors for that system being known, and it becomes an easy matter to determine the number of teeth and pitch for an "equivalent wheel" with teeth on any other system, provided also that the relations between the strength factor and number of teeth are known. Thus with the aid of Fig. 12 it is easy, given a wheel on one system, to find the equivalent wheel whose teeth are constructed on any other system for which a curve exists.

Taking a wheel with 16 teeth, 15 degrees obliquity involute, and normal addendum, the point d locates its strength factor. Joining d to the origin of coordinates and producing this line to cut the curve A at a, we see that if the obliquity is increased to 20 degrees and the addendum reduced to $\frac{1}{5}p$, the pitch can be decreased till the number of teeth becomes 35. With more than this number the strength would become less; with less teeth the strength would become greater. Again, if the obliquity were 14½ degrees and addendum reduced to $\frac{1}{5}p$, the equivalent wheel could contain 28 teeth, without reduction of strength.

As in the case of cycloidal teeth, this increase in number of teeth, for the same size and strength of wheel, is accompanied by increased efficiency, owing to diminution of the rubbing between the teeth due to decrease of the arc of contact.

The average wear of the teeth will also be favorably affected, for though it is true that the whole load is concentrated on fewer teeth, yet wear is reduced on the portions where abrasion is ordinarily greatest.

The following reasoning will explain what an important influence the power of diminishing pitch (afforded by the superior strength of the shorter form) exercises on wearing qualities. Consider the case of two equal wheels, each containing 20 teeth of ordinary proportions with involute profiles of 20 degrees obliquity; let

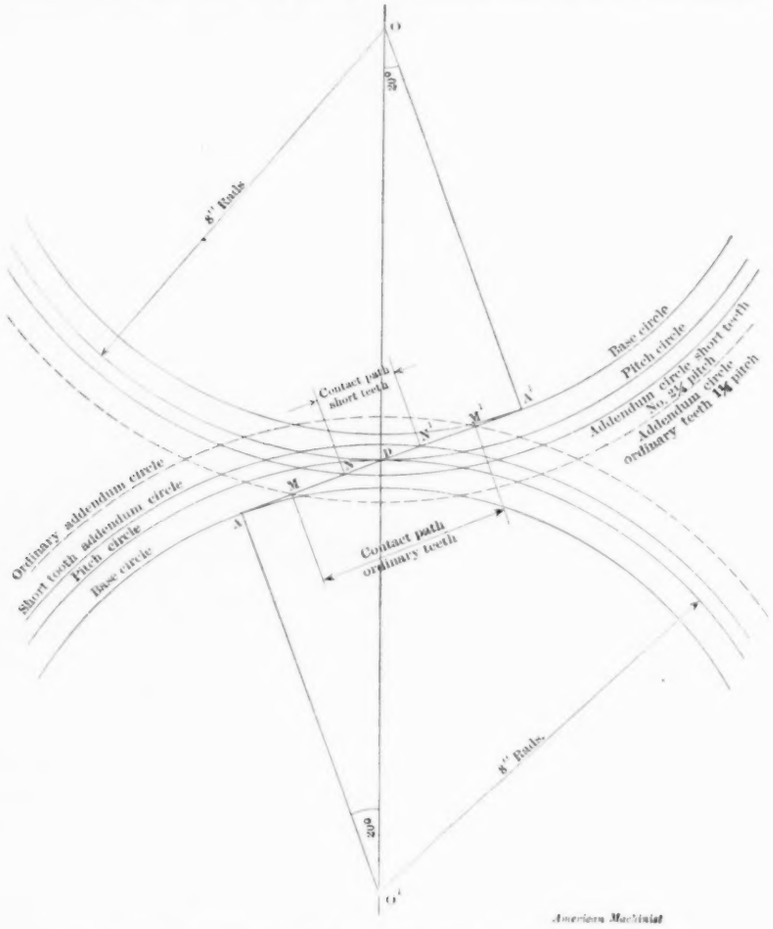


FIG. 13. COMPARATIVE WEAR OF LONG AND SHORT INVOLUTE TEETH.

the diametral pitch be 1¼. A pair of wheels with the same pitch surfaces, but with 36 teeth of 2¼ diametral pitch, of the shortened form and with profiles of the same obliquity, would have the same load-transmitting properties when running at the same speed. With the same pitch circles in both cases the addendum of the ordinary teeth would be .8000 inch, while with the shortened teeth the addendum would be $\frac{p}{5} = \frac{1.396}{5} = .279$ inch. The arc of approach a would be 1.95 inch, and the arc of recess b would also be 1.95 inches. So that arc of contact $a + b = 3.9$ inches. With reduced addendum $a' = .777$ inch and $b' = 777$ inch, so that $a' + b' = 1.554$ inches. Referring to Fig. 13, the pitch, base and addendum circles have been drawn for the two cases and also the two contact paths $M\,M'$ and $N\,N'$. The very substantial decrease from $M\,M'$ to $N\,N'$ should be noted.

At the outset it should be realized that the maximum rubbing velocity between the two surfaces of the teeth is reduced in the proportion $M\,p$ to $N\,p$, but this is not all. With the teeth in contact at the point M, the radius of curvature of the flank at M is $A\,M$, while that of the face of the tooth of the other wheel in contact with it is $A'\,M$. Also since the wheels are equal these generating radii sweeping out with their extremities small arcs of the profiles, move with equal angular velocities about their instantaneous centers A and A' which are situated on the base circles. The lengths of the profiles which come in contact while the path of contact shifts from M to some point very near it, will therefore be proportional to $A\,M$ and $A'\,M$ respectively. Hence it follows that on the same scale that $A\,M$ represents the length of profile passing through contact, $A'\,M - A\,M$ represents the amount of rubbing that takes place, and hence $\frac{A'\,M - A\,M}{A\,M}$ representing as it does the amount of rubbing per unit length of surface of the profile at M, is a measure of the tendency for the teeth to wear at the point M. With the reduced path of contact caused by reduction of the addenda this measure of wearing becomes $\frac{A'\,N - A\,N}{A\,N}$. With the scale values in the figure the maximum wear with the shorter teeth compared with the maximum wear on the longer teeth is as 1 to 5.23, and as, at the same time, the thickness of the teeth has been reduced only about in the proportion 1 to 1.8, the shorter tooth should last about three times as long for the same percentage reduction of thickness at the place of greatest abrasion.

The theory advanced offers an explanation of the fact that the one case in which the use of involute teeth is looked upon with disfavor is that of small pinions working with large wheels or racks. It will be seen that if the same size of pitch surface be retained the number of teeth can be so much augmented that low numbered pinions are no longer necessary. It is hardly necessary to point out that the reduction of pitch in such a case will be determined by a comparison of the strength of the racks and not of the pinions.

Turning now to the question of efficiency, it is not difficult to show that for wheels of the same pitch dimensions, speed and load, the ratio of work wasted to that usefully transmitted is:

$$\left(\frac{a^2 + b^2}{a + b}\right) k,$$

where k depends on the frictional co-

efficient and the dimensions and does not vary, while the sizes of the wheels and the friction remain the same. In the example now under consideration, with ordinary teeth:

$$\frac{a^2 + b^2}{a + b} = \frac{3.8}{1.95} = 1.90 \text{ nearly.}$$

With shortened teeth of reduced pitch:

$$\frac{a'^2 + b'^2}{a' + b'} = \frac{1.208}{1.554} = .778 \text{ nearly.}$$

Or the work wasted in friction is reduced to at least one-half. From this it is evident that all the advantages claimed in favor of shortening the addendum of cycloidal teeth are equally applicable to the case of wheels with involute teeth.

A Case-Hardening Job.

We did a job of case-hardening here a short time ago which I think will be of general interest, on account of the way in which it was done, as we had no facilities for doing work of such size and used just what we could lay our hands on. The pieces to be case-hardened were six large rings for two ball bearings, as shown in Fig. 1. These bearings were to carry the trunnions of a frame supporting a large Reeves variable speed transmission device. We first tried to case-harden the rings by heating them in a furnace and then laying them on a bed of cyanide of potassium for a minute or so, then reheating, sprinkling with cyanide and hardening in cold water. This left the outside hard enough, but the rings sprung a little in cooling, and by the time they were ground true the case-hardening was ground off in several places. We had no pot or box large enough to pack the rings in for case-hardening in the ordinary way and no furnace large enough to heat the box, so we improvised both of them.

Fig. 2 will give some idea of the pot. The bottom was a casting molded on a pulley machine. The inside of the box was a piece of 6-inch pipe screwed into the hole in the bottom castings, and the outside was a piece of 12-inch pipe also screwed into the casting. This left a hole 6 inches in diameter clear through our "box."

The rings were packed in the "box" in ground bone which had mixed with it a little cyanide of potassium, and right next to the rings, on the sides wanted the hardest, considerable cyanide was placed. When the box was packed, a little fireclay was put on over the bone and a piece of old chain was bedded in the clay to hold it together, more clay being put on top of the chain, thus sealing it air-tight. Fig. 2 will give an idea of how the packing was done. In different parts of the pot several "test pieces" were placed. These were simply small pieces of as near as possible the same kind of metal (machine steel) as the rings were made of, and were packed in exactly the same manner as the rings. These test pieces were hardened and broken across, after the pot was dumped, in order to determine how deep the carbon had penetrated in case-hardening.

When the pot was completed the problem was to heat it uniformly and keep it at a good heat for several hours. We cleaned out the hearth of one of our forges, which was about 30 inches across, and placed a cast-iron plate, about 8 inches in diameter, directly over the tuyere, but held about ½ inch above it by three small supports; this was done to spread the blast. Firebrick were then laid on the hearth of the forge, in the form of a circle, with as large a diameter as possible. This was built up until it was about 2 feet high (see Fig. 3). The firebrick used were ordinary straight brick, about the size of building brick. No mortar of any kind was used and no attempt was made to keep the joints particularly tight. At first the bricks were "chinked up" a little with molding sand and clay, but when the fire was started this soon fell out and the fire worked better than before.

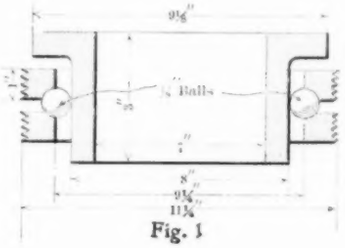


Fig. 1

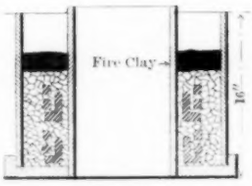


Fig. 2

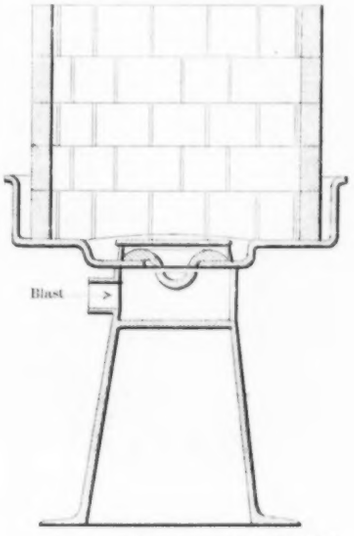


Fig. 3

A CASE-HARDENING JOB.

When this temporary furnace was completed, a coke fire was started and kept going to the depth of about 5 or 6 inches, and the box to be heated was placed on top. The hole in the center of the box and the space between the box and the sides of the furnace were then filled with foundry coke. The top of the box was just about level with the top of the furnace and the coke was mounded up over it. With a little blast on, the coke was all on fire in about three quarters of an hour, and the blast was left on for about two hours more. The small chinks between the bricks seemed to help considerably by admitting air to the burning coke, and after the blast was shut off, enough air came through them to keep the fire burning for several hours. About two hours later the blast was again turned on for about an hour. About seven hours after the pot was first put on the fire it was lifted from the furnace, its contents were dumped, and the rings and test pieces were cooled in cold water. The rings were case-hardened satisfactorily, and on breaking the test pieces it was found that the carbon had penetrated over 1-16 inch, giving a hard coating to that depth.

JOHN L. BACON,
Instructor in Forge Practice, Lewis Institute, Chicago.

Mechanical Antiquities of America —I.

BY EDWARD P. BUFFET.

HENRY F. FRASSE, THE OLD NEW YORK MACHINIST.

It may be that all true mechanics are artists, but not all artists are mechanics. Henry Frederic Frasse was both; Robert Fulton thought he also was both, but was mistaken. He did not even know that the starting bar of an engine ought to be larger at the fulcrum end than at the handle.* Fulton came from Connecticut and Frasse came from Switzerland. They met in New York, and together they worked out means to make boats go by steam. They also devised means to make boats go to the bottom. Perhaps their artistic temperament helped to draw them together. The musical temperament creates discord between people; the arti-tic produces harmony.

*My friend William L. Stone, 2d, the historian, well knew Ransom Cook, who, when engaged upon electro-magnetic machinery in New York in 1837, employed two men that had worked for Livingston and Fulton while perfecting their steamboat. These men stated that Fulton's ignorance of mechanical matters had rendered him a laughing stock of the hands. Perhaps these mechanics had worked under Frasse. Later on Cook had a shop and laboratory of his own at Saratoga Springs, N. Y. He was the patentee of an improved auger which removed the chips better than the old kind. The story of the invention is rather curious. Cook observed a borer insect working his way into a tree and ejecting the chips with facility. This led him to think that the end of an auger might be constructed on the same principle as the cutting apparatus of the insect. He therefore secured one of the little animals, brought it to his laboratory, examined it under a microscope, and utilized the knowledge gained.

The land of Savoy lies on the borders of France, Italy and Switzerland and has at various times changed owners. Within its ancient boundaries Mont Blanc is situated, also a romantic waterfall near Sallenches, which is called the "Cascade du torrent de la Frasse." To judge from their scutcheon, the Frasse family have lived in Savoy since sable bears were rampant. Of this family was born in 1781 Henry F. Frasse. His native place is given as La Brevine, in Neufchatel, which lies a little distance from Savoy within the Swiss line, and beyond the northern shore of Lake Geneva. I think it is Victor Hugo who has pointed out the ennobling effect of mountain life upon the inhabitants of a land of great hills. This is easy to understand. When you get up high you have a broad horizon. The broader it is the more you want to broaden it: such was the case with young Frasse.

Some time ago there came to the

HENRY FREDERIC FRASSE, FROM AN OLD DAGUERREOTYPE.

"American Machinist" office an energetic-looking youth with a good letter of recommendation from a well-known Swiss machinery establishment, where he had worked. He could speak about as much English as one of the editors could of French and another of German, and by putting in a few words here and there in each of the three tongues a remarkable conversation was carried on. He had learned enough in his trade at home for the present, so he had come to push his way through the foreign shops and learn more. He soon got a job as draftsman in one of the leading American plants.

A hundred years ago Henry Frasse must have been his double, only rather more of a linguist. Ultimately, Frasse's acquirements are said to have embraced seven languages. Conversant with French, German and Italian, he traveled and worked as a journeyman through the countries round about, wandering down into Italy and picking up plenty of mechanical information by the way. Nearly every man in Switzerland who is not a watchmaker is a clockmaker, and naturally among other things Frasse learned a good deal about watches and clocks.

Napoleon Bonaparte happened to come along just about that time and Frasse went into the army and became a lieutenant. Lieut. Frasse did not choose to follow Napoleon's career very long, for he was fitted for a more useful occupation. But his "Wanderjahr" was not ended. In 1803 or thereabouts he left his native land for America. One of his drawings is a stipple sketch entitled, "Farewell to Switzerland."

A few years later he was found established in New York city at his trade and ready to turn his hand to any sort of machine work from a watch to a steam engine. One of the things he knew how to do was to make clock tools on the blanking press. New York at that time was even less of a toolmaking center than it is to-day, so circumstances as well as his personal qualifications favored his soon attaining a leading place in his line of industry.

It was about this time that Robert Fulton, portrait painter, promoter and jack-of-all-trades, came along with steamboat wheels in his head and called upon Frasse to help him. A model engine was needed to start with. Frasse made the patterns and had castings run at a foundry in East street, New York. One Sabbath afternoon there was a great sound of alarm among the ducks and geese of the Collect pond on Centre street, for a new and diabolical sort of web-footed mechanical bird was seen paddling about almost as fast as they could themselves, and making even more frightful noises. The good people who passed the pond on their way down from the Bowery to attend service at Trinity or St. Paul's, their minds fixed upon other and more appropriate kinds of Collects, were much concerned at the spectacle—for New York was not such a "wide-open" town in those days as it was destined to become a hundred years later. However, the steamboat went, in spite of predictions to the contrary, but the pond was filled in ere long, and to-day the Tombs prison marks its site.*

The outcome of the experiment was that Fulton took his model over to England and had a larger engine built by Bolton & Watt. Under the steam of this the "Clermont" made her first historic trip on the Hudson. But the engine of the Frasse boat on the Collect pond had antedated it, if we can depend upon a straightforward tradition. Some of the pattern and casting work for one of these early models is still in possession of Mons. Frasse's grandson and namesake. There is a walking beam, an upright support for the same, and a pitman.

Fulton had other ideas besides that of making money out of steamboat monopolies. He was a humanitarian and was afflicted with a peculiar form of philanthropy, which has troubled people in much later times than his. He thought that by constructing sufficiently formidable engines of warfare he could render war impossible. This was in the epoch when blockades, embargoes, British claims of right to search and Barbary assumptions of right to waylay and despoil contributed to make things lively for American vessels that ventured off shore. Fulton hoped that by the invention of mines, torpedoes, submarine boats, and such like, he might accomplish "the liberty of the seas." He even wheedled out of the English Government a captured Danish brig, which he blew up with one of his curiosities to show how cleverly it could be done.

CASCADE DU TORRENT DE LA FRASSE, IN SAVOY.

Among others of his inventions was a clockwork torpedo with an arrangement for harpooning a man-of-war. The harpoon was to be shot from a swivel gun on a rowboat, so as to catch the ship under the bows. It dragged after it the torpedo attached by a rope, and calculated to be drawn up against the vessel amidships. In the torpedo was a train of clockwork, which could be set so that at the end of a definite number of minutes it would release a hammer carrying a flint, ignite the charge and blow up the ship. This clockwork was made and repaired by Henry Frasse. In one of Mr. Frasse's account books has been found the following entry:

"Dt. Mr. Fulton a Henry Frasse:

"26th May, 1810—Fulton repare un turpedos, le grand ressort, volant et roue, 4.50."

This harpoon torpedo was unquestionably a fearful engine of war, and quite capable of sinking any vessel of the Swiss Navy. Benson J. Lossing, in his "Pictorial Field Book of the War of 1812," has

*This Collect pond was a beautiful sheet of water, which had an outlet into the Hudson along what is now Canal street. It was deep, fed by springs and contained many fish. The unsuppressed activity of these springs was responsible for the unhealthy dampness of the old Tombs.

something to say about Fulton's submarine infernal machines, but does not admire them. He states that for harbor defence a single monitor is worth more than a million mines—a foolish assertion indeed, since a million mines would clog up a channel so as effectually to prevent the entrance of any warship. Mr. Lossing's sense of proportion is sadly distorted; he allows Mr. Frasse only a sub-footnote in his big book, although admitting that the latter was at this time the only machinist of note in New York city.

The year 1816 separates what might be termed the prehistoric and the historic portions of Henry Frasse's career. It is to that year that his business is traceable on a distinct mercantile basis. By that time he introduced a commercial line of jewelers' supplies and the like, founding a house which may fitly be called the root of the machinists' supply trade in New York city. He is said to have been the first extensive importer of jewelers' supplies into the United States. Thus he became the promoter of important business relations between his adopted and his native country. He is credited with having taken sixteen or eighteen trips back to Europe, which implies that he went about once in two years, making himself a noteworthy traveler for the time in which he lived.

The name of Fulton was associated with him from first to last, for his place of business was at 95 Fulton street. This has long been one of New York's busiest and most familiar thoroughfares, and in latter years the "American Machinist" first saw the light in a building just across the way from the site of M. Frasse's historic store.

M. Frasse had two sons, William Henry and Peter A., each of whom was destined to sustain the reputation of the name in the machinists' supply business through the second generation. William Henry, who was born in 1818, went to Switzerland at the age of fourteen to learn the trade of a toolmaker, and remained there four years. He was employed in Le Locle, near Chaux de Fonds.

About the year 1844 various changes took place in the Frasse business, so that in a New York city directory a year or so later we find the following entries:

"Frasse, Henry F. & Son, watchmakers' tools, 95 Fulton.

"Frasse, Peter A., importer of watches, 95 Fulton, h. 95 Fulton.

"Frasse, William H., watchmakers' tools, 81 Chatham."

The "son" in the first entry was Peter A. The Chatham street house in the last was the original of what is now the Frasse Company.

Mr. Frasse lived until the year 1849. The business on Fulton street was conducted by Peter A. until 1868, when it acquired the title Peter A. Frasse & Co., the "Co." being James M. Montgomery, who in 1876 set up for himself. Thus came into existence another of the best known supply houses in the city—Montgomery & Co. George W. Church—still another familiar name in the trade—is a descendant of Henry F. Frasse.

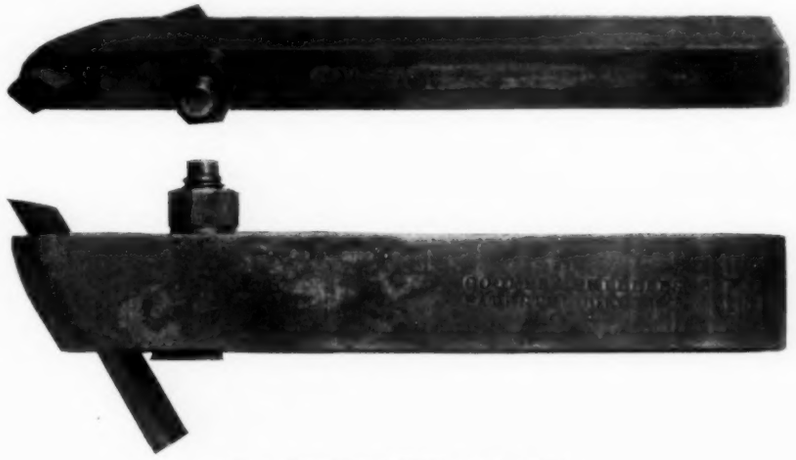
In 1876 John L. Howe was taken into the Fulton street firm and after Mr. Frasse's death it was incorporated as Peter A. Frasse & Co., Mr. Howe being to-day president*, and Adolph E. Brion, secretary. One of Mr. Frasse's account books dating about 1816 was exhibited in the window some years ago. It was written in French and showed accounts with Robert Fulton, who seems to have been a faithful customer. Within a few years the concern has moved across the street from the old stand.

We left William Henry doing business on Chatham street in 1844. From that time down to the present the course of this house has been parallel with that of the Fulton street one. After staying on Chatham street for half a century it is now situated on Cortlandt street, under the personal management and control of Henry F. Frasse, 2d, grandson of the founder of the family in America. Like his grandfather, the present Mr. Frasse is a man of artistic temperament as well as mechanical proclivities. From a daguerreotype belonging to him is reproduced the accompanying picture of his progenitor, which is the only one known to be in existence. The possession by Mr. Frasse of some of the Fulton steamboat models has already been noted.

That the Frasse interests have been fruitful of mechanical progress, as well as commercial influence in days much later than Fulton's time, is shown by the accompanying illustrations of an inserted cutter lathe tool patented in 1866 by Cooper & Phillips, two men who are said to have been in the employ of William Henry Frasse, proprietor of the Frasse Company. It is believed to be one of the earliest, if not the earliest, of its class. This particular tool was presented by Mr. Frasse to the late Prof. Eggleston of Columbia College, and is now in custody of the son of the former.

The venerable engineer and author, Chas. H. Haswell, has kindly furnished me with a few facts regarding Henry F. Frasse, the 1st. He writes: "I knew Mr. Frasse well. He was a machinist of a high order and a very worthy man. He executed the fine work of a toy fire engine (one practicable of operation) I made (1821) with cylinders from the sliding ferrules of two old umbrellas and a joint of an old spy-glass for an air vessel. His shop was in Fulton street below William. Another remarkable man was Conroy, the fish material maker. I knew him *ab initio*. A second fire engine of mine was borne in a firemen's parade."

It will be noticed that the little fire engine built by Messrs. Haswell and Frasse was made just eighty years ago. Mr. Haswell, who was evidently a young boy at the time, is still practicing in this city as civil and consulting engineer. It is doubtful if another instance of a reminiscence so far-reaching as this can be found in the entire engineering profession.



EARLY INSERTED CUTTER LATHE TOOL.

So much for the history of Henry F. Frasse, the man who may justly be called the father of the fine-tool trade in New York city. The Frasse interests are claimed to be the oldest of the kind still flourishing in New York State at least. I will add the assertion that they are the oldest in the country. That is at least the surest way to flush somebody who thinks he can go them one better.

* Since these words were put in type Mr. Howe has passed away. Only a week before his death he was at his office as usual and I had the pleasure of showing him a preliminary draft of the article. He was a man of uncommonly excellent and amiable qualities.

Officials of the Allis-Chalmers Company are reported to have hit upon a new plan for preventing defection of employees. Vaudeville shows are provided for the entertainment of the men who have been secured to take the places of the strikers at Chicago. The new men have been compelled to live in the plant and the lack of amusement had resulted in much discontent and many desertions.

Three Fixtures for Machining a Special Casting.

BY WILLIAM DORAN.

The three fixtures here described were made for machining the cast-iron bracket, Fig. 1, and they show how accurate repetition work can be accomplished by the use of comparatively simple and inexpensive fixtures.

The machine operations with these fixtures are facing the base, drilling the four screw holes *B*, the two dowel-pin holes *C*, and lastly, finishing the three cored holes *D* and facing the hubs at *E*. As the castings were of medium size and could be handled to the best advantage on the smaller machine tools, the milling machine was adopted for machining the base, and the fixture, Fig. 3, and the face mill, Fig. 2, were employed.

Holes were first bored through the two standards *G G* to fit a piece of cold-rolled shafting, which would pass through the

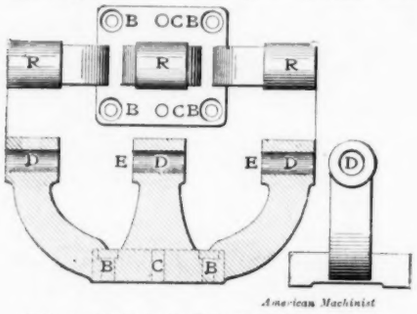


FIG. 1. THE CASTING TO BE MACHINED.

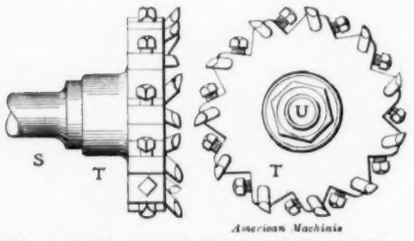


FIG. 2. THE CUTTER HEAD FOR FACE MILLING.

cored holes in the work with ease. The casting was then removed to the milling machine, and the base was planed and a channel let in for tongues *K*. The two lugs for the face-locating screws *N* and for the fastening screws *M* were drilled and tapped and also the one for the end screw *P*. Lug *Q*, which acted as the end-locating point for the work, was faced. The five locating and fastening set-screws were made rather large in proportion to the rest of the fixture.

The shaft used for locating the work shown in position at *H* was a piece of cold-rolled shafting, an easy fit in the standards *G*. One end of this shaft was heavily knurled at *I*, to allow of its easy inserting and removal. The two face-locating screws were set so that an equal amount of stock would be removed from all points.

This fixture is used as follows: A casting is placed on the fixture, and the shaft *H* is slipped in. The two fastening set-screws *M* are tightened to locate the base against the two locating screws *N*. The set-screw *P* also is tightened, which forces the work against the end locating face of the lug *Q*. The face mill, Fig. 2, is then used and the base is milled, setting the table of the miller to remove stock sufficient to leave the centers of the cored holes in *R R R* the required distance from the base.

The face mill, Fig. 2, although of a rather primitive design, is about as cheap and effective a tool for the machining of work of the class shown as could be desired. The cast-iron holder is bored and keyed on to the taper machine-steel shank *S* and held against the shoulder by the nut. Eleven cutters, of self-hardening steel, are let into the holder in holes drilled at an angle to give the required rake to the cutting edges, and also to allow of setting the tools to take both a roughing and a finishing cut at the same time. This is done by setting a certain number of the cutters to project a trifle farther down than the rest.

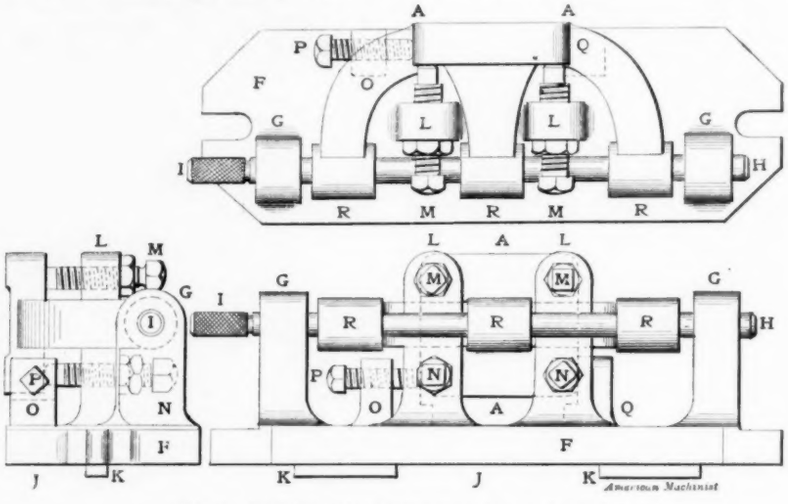


FIG. 3. FIXTURE FOR MILLING BASE OF CASTING.

The second operation is drilling the six holes in the base. The two holes *C* are for dowels which locate the bracket on the drilling machine of which it forms a part and the four holes for fillister head screws for fastening it on. The fixture is shown with the work in it in Fig 4. It is of the box type, the base having two cast legs *D* at opposite sides. A raised square section in the center serves as a locating face for the base of the work. The locating of the work on this face is accomplished by eight set-screws let into the projecting lugs at a slight downward angle. Those through lugs *H H* and *G G* are headless, and they are the locating points. They are hardened and finished to screw tightly into the lugs. The four fastening screws, through the lugs *F F, I I*, have heads. The lid of the fixture is of cast iron, and it is located on the body casting by the two dowel pins *K K*, there being hardened bushings let into the lid to accommodate them. The lid is fastened by two swinging clamp studs and nuts at *J J*. A square hole *O* in the center of the lid allows clearance for the central hub of the work. The locating and finishing of the six bushing holes were accomplished in the usual way—that is, by the button method, getting accurate distance between the holes, from the jig used for drilling the duplicate holes in the part to which the bracket was attached. Although the use of the set-screws, as shown, may not seem reliable to some, they proved satisfactory and positive, and a slight adjustment of the locating screws at infrequent intervals was all that was necessary to insure the accurate drilling of the castings. The design of this fixture is such as to allow of the easy escape of all dirt and drillings. The clearance holes through the base of the fixture for the drills are a great deal larger than the bushing holes. The counterboring of the four screw holes for the fillister head screws is done by simply resting the bracket on the table of the drill press and using a long shank counterbore with a tit which fits the drilled holes.

The fixture, Fig. 5, used for boring the cored holes *D* and facing the hubs at *E*, is a very simple affair. It is an angle plate with a stiff supporting rib at *J*, a raised locating surface on the front at *K K* for the work, and projecting arms at *I* and *H* for the boring bar bushings. The work is located by the two dowels *N N*, and is fastened to the locating face by four clamps *O* and bolts *S*. The clamps are slotted to slip freely on and off the work. The chief points of accuracy in making the fixture are the locating and finishing of the boring bar bushings *M* and *L*, the finishing of the locating face to the exact distance required from the center of the bushing holes, and, lastly, locating and finishing the holes for the two locating pins *N N*. The two bushing holes were located and finished first, using a boring bar and cutters, fastening the casting to the drill press table, finishing the holes in line and to the same size. The locating face K K was then finished, getting the distance from the center of the bushing holes

by inserting a tight fitting shaft through them, measuring with a hight gage and adding one-half the diameter of the shaft. This surface was machined on a large "Garvin" miller, with a face mill. The finishing of this surface in the relation required with the bshing holes was no light job, as no error was allowed. For locating the two dowel-pin holes a casting or bracket which had been milled and drilled in the first two fixtures, was clamped to the locating face of the fixture by the four clamps shown. The boring bar was then slipped through the bushings and through the cored holes of the work. The three cutters were fastened in the bar and rested on the hubs of the work. The casting was then adjusted on the fixture until the three cutters of the bar were in an approximately central position on the hubs—that is, so that an even amount of stock would be removed by the cutter all around the holes, and, as far as possible, the same amount from each. This done, the bar was removed and the two holes for the dowel pins were drilled and reamed through those drilled in the work. The pins *N N* were then got out and were driven into the fixture.

To use the jig, it is first placed on the table of the drill press and the work is located and fastened upon it. The boring bar without the cutters is inserted, and the fixture is located on the table so as to allow of driving the bar up into the spindle and so that the end will pass through the center hole freely. The fixture is then clamped to the table by bolts through the slots *X*. A set of roughing cutters are fastened in the bar, the feed is thrown in and the cutters are fed through the cored holes. These cutters are now removed, and a finishing set substituted, and the holes are finished to size. For facing the hubs, another set of cutters are used, and are fed down a sufficient distance to clean up all three hubs.

American Locomotives in India.

The following, from a letter of the chief engineer of the Bengal Central Railway forwarded by Consul-General Patterson from Calcutta, gives some interesting information concerning American locomotives in India:

Five American engines were received and started to work in July and August, 1899. At the commencement of their career, the engines did not steam freely, and the fuel consumption was also very high—almost 70 pounds per mile. This was, however, remedied by the introduction of the following alterations, viz.: (1) One single-exhaust pipe and blast nozzle (in place of double pipe and nozzle); (2) all deflecting plates removed from smoke box; (3) new fire-grate bearing bars to take 22 fire bars in place of 24; (4) new regulator valve of the State Railway type in place of single double-face valve; (5) india rubber feed pipes in place of brass castings ball and socket; (6) lubricators for pistons. Their performances at the present time are equal to the engines sent out by Dubs & Co. and Nasmyth Wilson & Co. The fuel consumption has also been brought down to 40.5 pounds per mile.

The fuel consumption is as low as that of the British engines, after being altered here by me. The American engines have run 188,440 miles since August, 1899, and no duplicates have yet been used, except

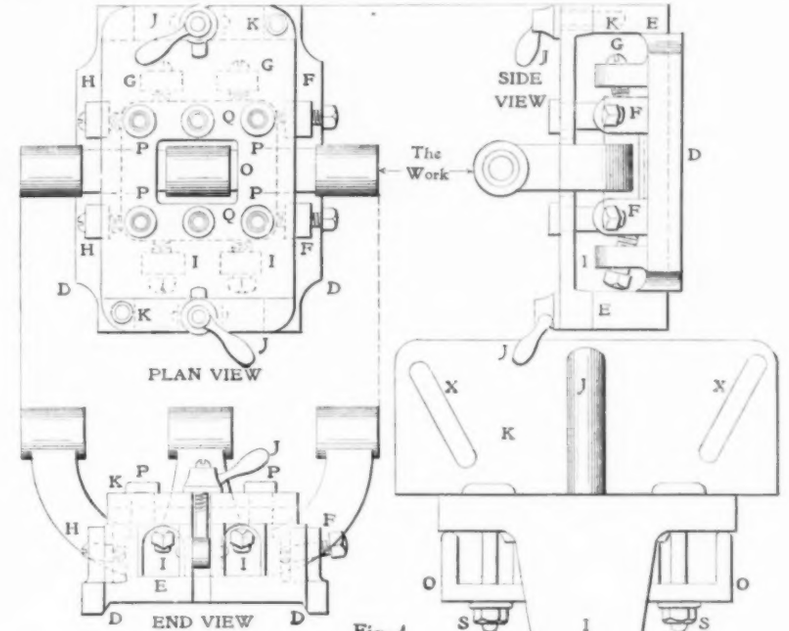


Fig. 4

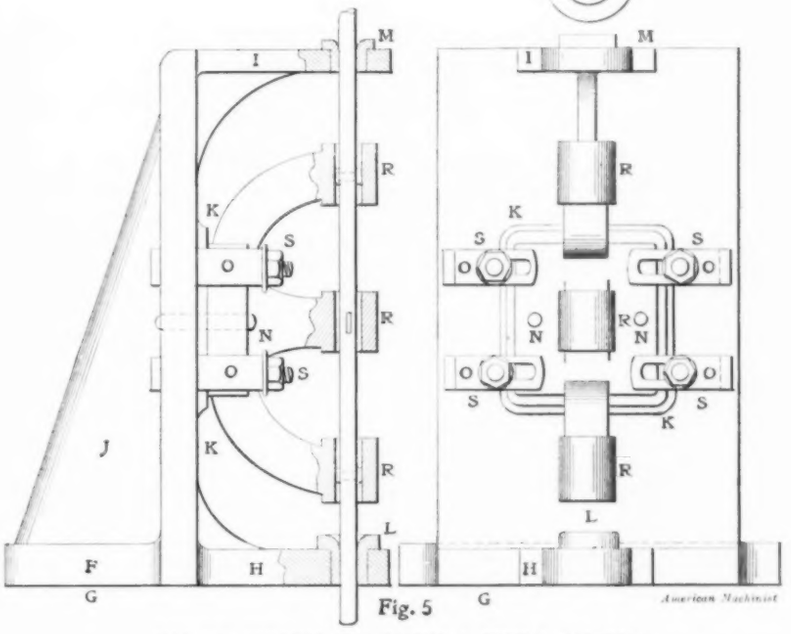


Fig. 5

JIGS FOR DRILLING AND BORING A SPECIAL CASTING.

The cost of American compared with British engines is as follows:

Description.	Cost.	
Americans with steel fireboxes and steel tubes, delivered in 75 days	£2,120	$10,317
Americans with copper fireboxes and brass tubes, delivered in 75 days	2,427	11,811
Neilson & Reid's bogie, delivered in 12 months	3,060	14,891
Dubs & Co.'s bogie, delivered in 17 months	3,000	14,560
Sharp Stewart's bogie, delivered in 21 months	2,985	14,527

the turning up of the bogie wheels of one of them. They are all, however, showing a tendency to have sharp flanges. The engines pull well and run much easier than the British locomotives. Since they were put to the lines, no repairs excepting the ordinary trifling ones were done. One has, however, been sent to the shops lately for somewhat heavy repairs, on account of its sustaining damage in a collision.

Since forwarding the above report of

the American engines in November, 1900, these engines have been running heavier trains during the first half year of 1901, owing to the stoppage of all "goods trains." With these heavier loads, the American engines do not show so well in consumption of fuel as the English engines by nearly 3½ pounds per mile. The consumption of oil is also heavier—almost 1 pound per 100 miles run.

Letters from Practical Men

A Drill Jig and its Excellent Work.

Editor American Machinist:

Although you have recently published a number of interesting articles on the methods of making and using drilling jigs, some of your readers may find something new in a drilling and reaming jig described herein and which has proved of value in producing work in which great accuracy is required. The tool I write of has been in use more than three years, and while nearly 4,000 castings have been operated on with it, the bushings show no appreciable wear. I submit a pair of castings, taken at random from a recent lot, to show the accuracy still maintained.

The essential feature of this tool is in the method provided for closely guiding the drills and reamers and at the same time preventing their contact with the bushings, so that the wear on the drills, reamers and bushings is reduced to a minimum.

I think everyone who has used drilling jigs for manufacturing purposes, in which the drills fit the bushings, has found that the chips soon wear the bushings perceptibly and that it is necessary to replace the bushings from time to time in order to maintain the accuracy of the work. This is something to be avoided if possible, as taking out and putting in bushings, particularly in cast-iron jigs, often impair their strength and accuracy.

The castings referred to are side frames of the Burroughs registering accountant, and as the majority of the holes have the same relative position in both sides, the jig is made reversible—feet on both sides, the clamps *G* and supporting plate *E* arranged to fasten the right-side frame to one side of the jig and the left-side frame to the other.

The jig itself is a plain cast-iron plate *D*, the feet *C* of tool steel, hardened, shouldered on one side of the plate and fastened by nuts on the other.

All the bushing holes were bored and reamed on a milling machine, the positions verified by hight-gage and vernier, and are of uniform size. This is a feature of importance, as it simplifies taking measurements, making bushings and boring holes. Great care was taken to avoid distorting the plate when putting in bushings, some being forced in from one side and some from the other, to equalize the strains. The holes in the bushings are of uniform size, regardless of the varying sizes required in the castings. Extension sockets, Fig. 3, to fit the drill-press spindles are made with the lower ends hardened and ground to close fits in the bushings. These sockets are fitted with the various sizes of drills and reamers required and project only far enough to get through the work. The bushings are flush with the jig plate

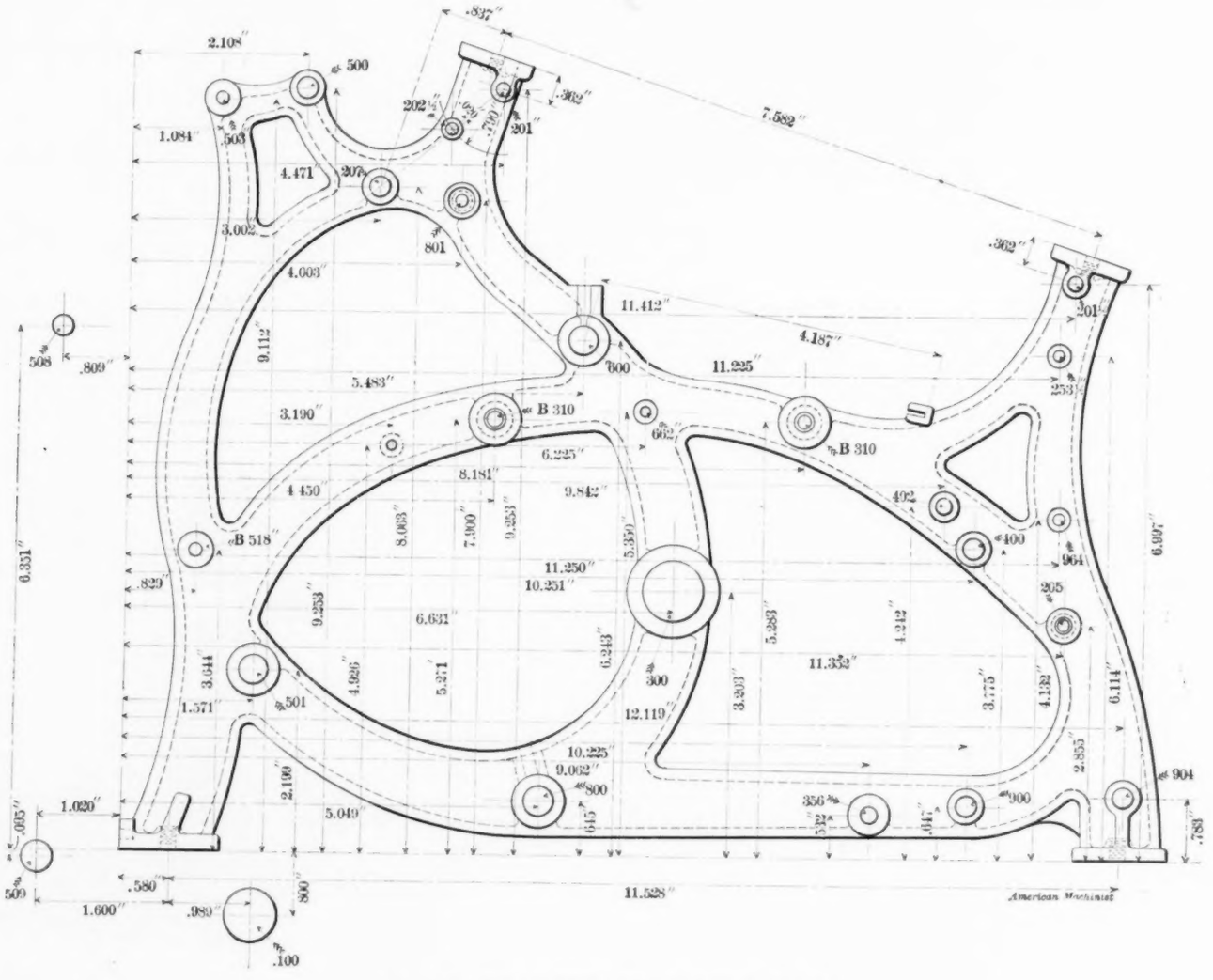


FIG. 1. WORKING DRAWING OF FRAME TO BE DRILLED.

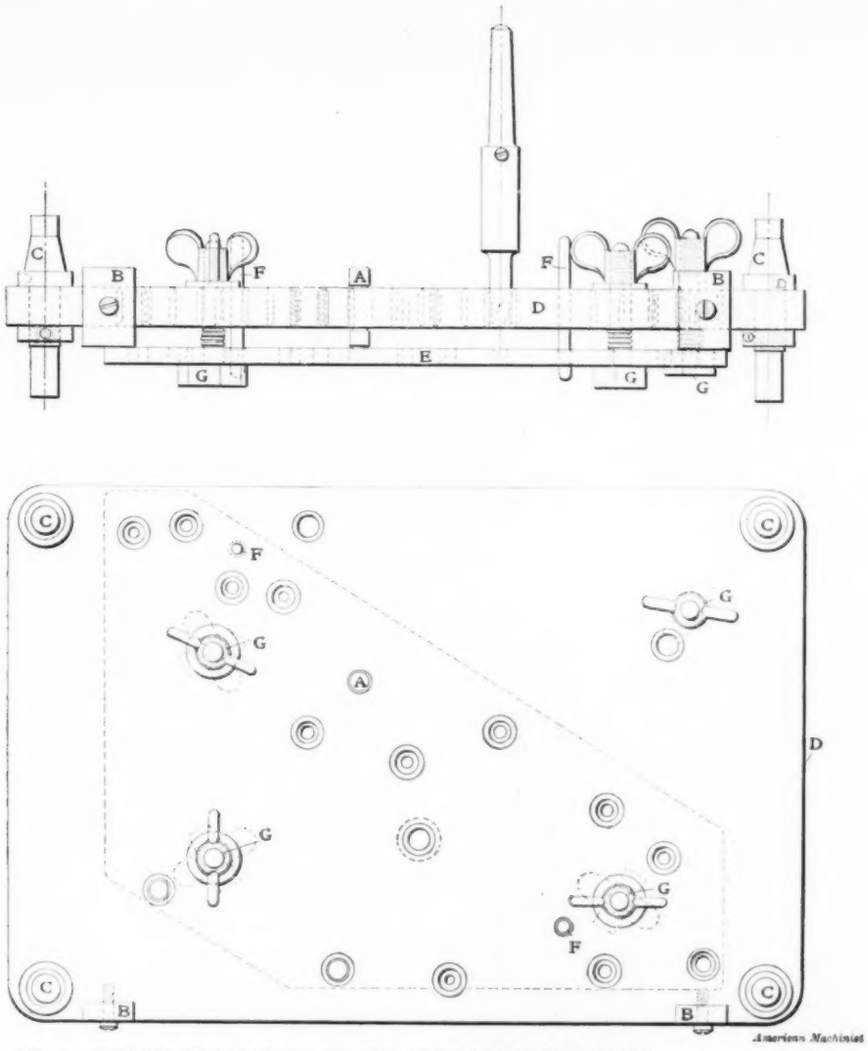


FIG. 2. DRILLING AND REAMING JIG, FOR RIGHT AND LEFT CASTINGS.

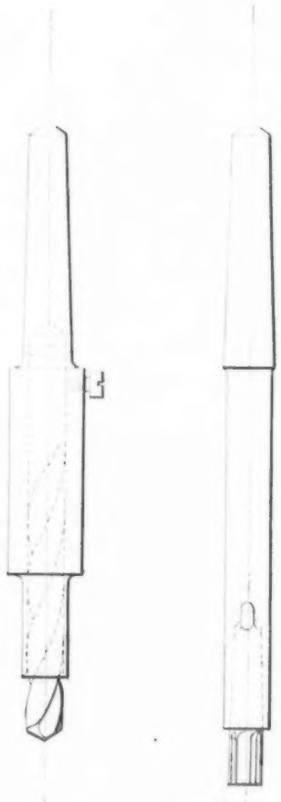


FIG. 3. DRILL AND REAMER IN COLLETS FOR JIG.

and are long enough to ensure the extension sockets being properly controlled before the drills and reamers touch the work.

W. H. PIKE, JR.

[The two frames referred to by Mr. Pike give an example of drill jig work which is certainly as good as we have ever seen, and much better than most such work. Three close-fitting plugs, made long enough to pass through both of them when placed side by side, may be changed about from hole to hole at pleasure and can be pressed in by the fingers and removed by such pressure upon as can be exerted with the end of a lead pencil. And when the plugs are in place, the flat milled surfaces are precisely even. One hole is first drilled in the frame, then the milling of the flat surfaces is done, gaging from the hole; after which the jig illustrated is used, gaging from the one drilled hole and the flat milled surfaces. The work is excellent.—Ed.]

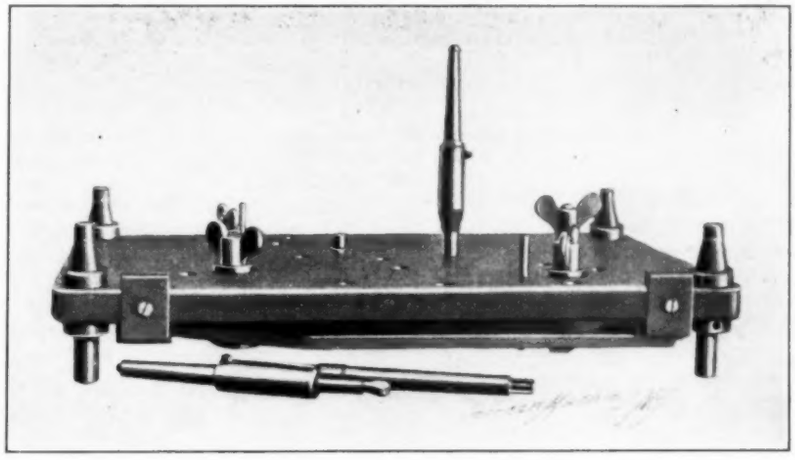


FIG. 4. VIEW OF JIG IN USE.

Varnishing Patterns.

Editor American Machinist:

My letter on "Varnishing Patterns," page 1144, has evoked a number of comments. A free discussion of any subject often helps to bring out valuable suggestions. That man is certainly to be pitied who is a stickler for any one method to the exclusion of all others, especially if there be any in advance of his own.

In regard to this matter, Mr. Ferris and myself are in perfect accord, but when he devotes most of his letter to the importance of haste and cheapness he has gone off on a tangent. For the life of me, I fail to discover what bearing his remarks have upon the subject of varnishing patterns. The incident from his own experience argues nothing either for or against the advisability of varnishing patterns. It simply goes to prove that he got hold of a slow workman. The varnishing of those 100 pieces took but a trifle of time, and

added but little to the expense of making. As compared with the real work to be done on the patterns themselves, the varnishing part is of trivial account. Every patternmaker knows well enough that a piece of work which has consumed days, if not weeks, in the making, can be easily shellacked in a few minutes, or, at most, a few hours. Besides, in view of the great liking my friend exhibits for the "black varnish" shop, it might be pertinent to ask, perhaps, does it take longer to spread yellow varnish than black?

"Old Bob" claims that, in stating my reasons for shellacking patterns, I failed to mention the most important of all, namely, the "waterproofing" of the wood by applying one, two or three coats. I wrote: "To impart a hardened surface to the wood, which will increase its durability." If this does not mean protection against water as well as rough usage, then the language must be inexcusably vague.

He puts this inquiry to me also: "Why should a patternmaker do any varnishing, anyhow, or sandpapering, for that matter?" Simply because, outside a few of the largest patternshops, where they have a separate room and a separate man to do this business, the patternmaker is obliged to do it himself. As already shown in this letter, the time consumed in the work of varnishing is, comparatively speaking, of little account, and adds but a trifle to the cost of an average job. When my article was written I did not have in mind any "Meissonier of the pattern shop" who with his artistic taste and fancy touches knew how to kill time.

Mr. Rayner's communication, though short, is a very sensible one. The arrangement of patterns according to color corresponding to the metal to be used is certainly an excellent one, and could be adopted with profit by all large concerns. As he wisely suggests, it would save much valuable time, as well as obviate considerable misunderstanding.

PATTERNMAKER.

Editor American Machinist:

"Patternmaker," page 1144, is evidently an adept in the art of varnishing, but in advocating the use of yellow shellac for all classes of work he sacrifices to his artistic instincts all the very best reasons for varnishing pattern work at all. The clear shellac is cleaner to apply and sandpaper than the black, but it is only fit for cheap work or "one-casting jobs," as it has not the body, durability or moisture-proof qualities of the black, which is much superior for standard patterns that are to be used constantly as long as they last. Any pattern from which many castings are to be made will sooner or later have a dark finish, so why not anticipate things by painting it black in the first place?

The style and shape of the flat brush that can be bought for 10 or 15 cents is excellent for varnishing pattern work, but the brush itself is "no good" for yellow varnish, because it is bound with tin and soon changes the color of the shellac from yellow to a dirty green, and all patterns look alike when covered with two coats of dirty yellow shellac.

The round paint brush used in many shops is bound with iron wire painted red, and it is the red paint on the iron binding of the round brush that makes it superior to the flat brush with the uncovered tin binding—that is to say, superior for yellow shellac, because the binding does not come in contact with or soil the shellac. To be sure, a little oxalic acid dropped in the shellac pot will clear it up; but a patternmaker is required to carry quite enough from job to job without adding acids or chemicals to the list.

HOBO.

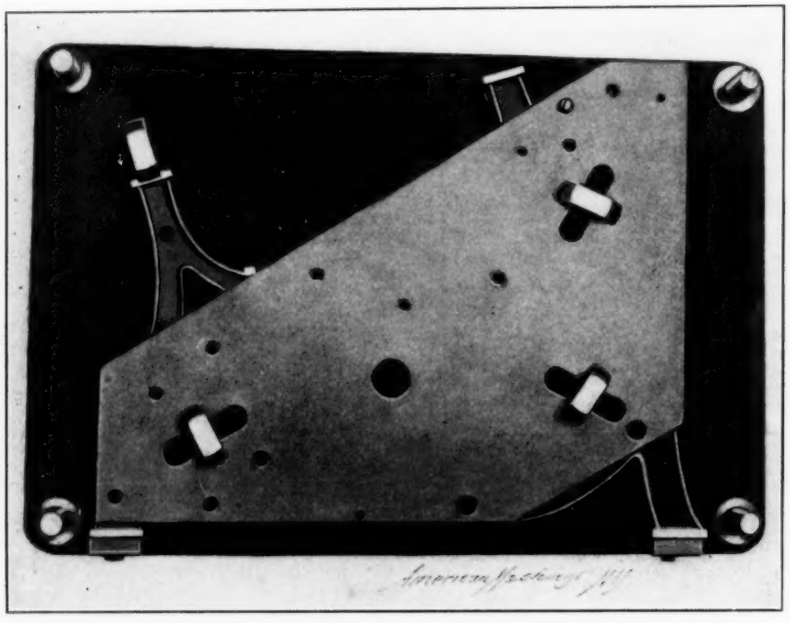


FIG. 5. BOTTOM VIEW OF JIG WITH CASTING IN PLACE.

A Shaft Assembling Jig.

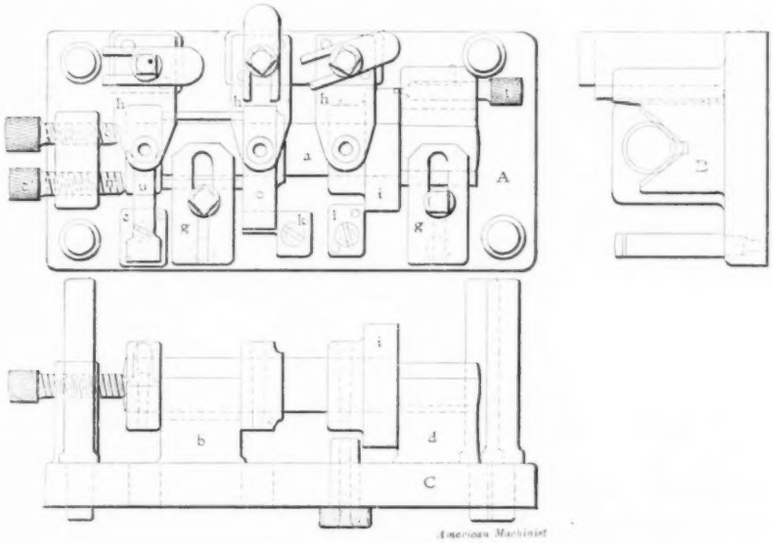
Editor American Machinist:

Thinking the accompanying fixture might be of interest to some of your readers, I send it to you. It is for drilling and taper reaming an assembled shaft. The jig is shown in three views, designated *A*, *B* and *C*. In *A* the shaft *a*, with gear *i*, cam *o* and lever *u* assembled on it, is clamped in position ready for drilling. The shaft itself sets in V-bearings *b* and *d*, which are part of the jig casting and shown in *B* planed to fit the two diameters of the shaft, so that it will set level. The parts of shaft which set in the V's are its running bearings. *b* is faced to just the length of that bearing, and the front side of *d* is squared to the proper distance for the shoulder of the shaft when the screw *c* forces the shaft endwise up to this gage point. Screw *m* keeps the lever *u* in position against the front side of *b*; *k* and *l* are gage blocks that keep the cam and the gear in their respective places. The block *e* locates the lever *u* in relation to its turning on the shaft, the top of *e* being level with the center of the shaft. The gear is located by pin *f* engaging between two teeth. The block *k* extends under cam *o* to form a stop. This was fitted by "cut and try" method until the timing came right. The work is clamped in place by plates *g g*, which slide back as shown to let the shaft out.

The jig is arranged to drill halfway through from each side, with one drill larger than the other to help in reaming. In *C* is shown a slip bushing which is used in each of the three holes in turn. The bushings through which the other side of the work is drilled are in the three plates *h*, and these need to be taken off out of the way, also the slip bushings are taken out, each time a shaft is reamed and another put in. The large hole in each of these plates passes over the head of the clamping screw easily, then a fork strap, as shown, is passed between the plate and the screw head, and it is clamped in this way. The plates are located by dowel pins, the pins being fitted snug, but still so that the plates can be lifted off without any trouble. By making the pins different distances apart in each plate there is no danger of putting them back wrong. The parts *o* and *i* would need to be squared to a constant thickness to use the gage points as they are placed here, but small thumb-screws could be put through *b* and *d*, and so allow quite a range of variation in the thickness of these parts. Nothing is provided for holding *i* in contact with *d* while it is being drilled, except the friction on the shaft, which should be enough; it could be easily held with the hand, however.

For a job of this nature, where a considerable number of shafts are to be se-

cured with taper pins, and where the parts on it are to bear the same relative position to each other, a rig something like this is very efficient. It produces work that is very nearly perfectly interchangeable. A part that was drilled and reamed on one shaft, if it would not assemble exactly on another, would do so with a trifle larger taper pin, and this would be very good indeed, when one considers how such work is too often done, the holes coming out of the centers of shafts and hubs. It is quite an unsatisfactory job to attempt to put two pieces together and try to use a hole that is already in one of them, especially if the hole is in the shaft. It is as often as not accomplished by disfiguring the work, using a much larger pin and perhaps having to actually weaken the shaft by drilling a hole one-quarter round. NAC.



A SHAFT ASSEMBLING JIG.

Examination for Piece-Work Computer.

The United States Civil Service Commission, Washington, D. C., announces that on December 19-20, 1901, an examination will be held at various places throughout the United States for the position of assistant piece-work computer. The examination will consist of the following subjects: Pure mathematics: Algebra, geometry (synthetic and analytic), trigonometry (plane and spherical), logarithms and calculus; spherical astronomy; practical astronomical computations. From the eligibles resulting it is expected that certification will be made to the position of piece-work computer in the Nautical Almanac Office, and to other similar vacancies as they may occur. Persons who desire to compete should at once apply to the Commission for application forms 304 and 375, which should be properly executed and filed with the Commission prior to the hour of closing business on December 9.

An American Engineer's Experience in Russia.

Modest William McCarroll, a type of the American engineer who does things, went to Sergieff, Russia, to set a consignment of Baldwin locomotives. He found them in parts, filling countless boxes dumped in the snow. A little railroad ran halfway to the main line on which the engines were to run. The interval was a hummocky waste. The thermometer was 20 degrees below zero. One by one from the sparse hamlets of the region he picked 125 Russian peasants; hoisted his boxes with ropes and primitive pries upon flat cars; ran the cars to the rail head, and scrutinized the steppe before him, ridges, gullies, holes and hills—with massive locomotive boilers to be transported across them. From the scant materials at hand he made a great sled, piled snow upon it and rolled a boiler in the snow. Half of the hundred peasants hauled on a long rope; the other fifty went ahead constructing trestles over the gullies and cuts through the iron soil of the hillocks. Day after day in the biting cold the human pack animals dragged those locomotive parts until all had reached the workshop—a frigid Russian hillside. At Philadelphia ten engines could be set up in a day; in Russia it took ten weeks for one.

Nor was there a holiday when the completed engines stood ready on the track. Water, which froze on the way, had to be carried half a mile and then melted. Mild fires had to be maintained to keep it melted. And when at last a wood fire was roaring in the firebox of the first locomotive, and the engine was proudly puffing up the new track, the rails spread two miles from camp and the engine went pilot foremost down the bank. Consider the plight of a single engineer, with a locomotive on its nose in a snowbank, a few wooden levers, a rope and a gang of ignorant Slavs! But "off again" with McCarroll was "on again," if it took all the White Czar's subjects to help him; for by dint of the snow shoveling and the tugging of 200 peasants the engine returned to the rails. Mr. McCarroll says the whole feat "took a little scheming." It may have been brilliant engineering.—"The World's Work."

We are able to add to this story that the Russians thoroughly appreciated the good work of Mr. McCarroll, and he received substantial evidence of that fact.

Shipbuilding Census Figures.

A preliminary report of the census covering a part of the manufacturing industries of the United States shows that during the ten years from 1890 to 1900 there has been an increase in the number of shipbuilding establishments in the United States from 1,006 to 1,083, or 7.7 per cent. These, and all the subsequent figures, relate to those outside of government control.

The capital invested increased during the ten years from $27,262,802 to $76,699,051, or 181.3 per cent., while the number of wage earners increased from 22,143 to 46,121, or 108.3 per cent.

Of the expenditures, the following is reported: The expenditure for wages has increased from $13,083,949 to $24,388,109, or 86.4 per cent.; under the head of miscellaneous expense there has been an increase from $1,392,551 to $3,582,257, or 157.2 per cent. The cost of material used in 1890 was reported as being $16,521,246, whereas in 1900 it was $33,031,280.

The total value of production in all these various establishments has, including custom work and repairing, increased from $38,065,410 to $73,444,753, or 92.9 per cent.

A. F. TENNILLE.

Personal.

Max Daunert, New York manager for Schuchardt & Schütte, has returned from a brief trip to Germany.

Obituary.

Hiram Mabie died at Peekskill, N. Y., November 15, ninety-five years old. Mr. Mabie had worked at the patternmakers' bench until he was eighty-four years old.

Thomas J. Kennedy sailed from this country September 18 to superintend the erection of mining machinery near Mysore in Southern India, under a contract of the General Electric Company with the British Government, and information was lately received that he died early in the present month. Mr. Kennedy was born in Pottsville, Pa., in 1853. His technical and mechanical education began with three and a half years' attendance at Cooper Institute in this city and an apprenticeship at the Taunton Locomotive Works. He later had experience with John Roach and William Sellers & Co. Later he was mechanical superintendent of the National Storage

Company, and for several years was a traveling inspector for the Ingersoll-Sergeant Drill Company. Mr. Kennedy's name was on the list of members of the American Society of Mechanical Engineers to be elected at the next meeting. He was warmly and highly esteemed by those who knew him.

John A. Johnson, president of the Gisholt Machine Company and the Fuller & Johnson Company, Madison, Wis., died November 10, seventy-one years old. Mr. Johnson was born in Gisholt, Norway, and came to this country when twelve years old. He worked on the farm and taught school and then began selling farm machinery. In 1862 the Fuller & Johnson business was started for the manufacture of agricultural implements and it has grown to be one of the largest establishments of its kind in the Northwest, the line of implements manufactured being largely the invention of Mr. Johnson. The Gisholt Machine Company was started a dozen years ago, and its success our readers are sufficiently informed of. The company was named after Mr. Johnson's native town. Associated with him in this enterprise were his four sons, all of whom are practical machinists. Mr. Johnson was a public-spirited man, had served in both branches of the legislature and in other offices, was connected with many public enterprises, and was very highly esteemed and respected.

New Catalogs.

The Goodman Manufacturing Company, Halstead street and Forty-eighth place, Chicago, Ill., has sent us "Catalog B" (9⅜x6¾ inches), describing the Goodman electric chain breast coal cutter.

There has come to us a catalog and price list of gear and milling cutters, metal slitting saws, reamers, counterbores, round head cap screws, etc., manufactured by R. M. Clough, Tolland, Conn. It is 3¾x6 inches.

A new edition of the catalog of the Austin Separator Company, Detroit, Mich., has been brought out. It shows a line of steam separators, oil and ammonia separators and spraying device, and is 6x9 inches, standard size.

The Compagnie Continentale Geo. Richards, Paris, devotes section A of its 1901 catalog to the Raboteuse Laterale "Richards" (Richards side planer). The pamphlet comprises also a condensed catalog of other Richards tools. Size, standard, 6x9 inches.

We have received sheets, of catalog nature, describing improved adjustable duplex die stocks made by the Hart Manufacturing Company, Cleveland, O. One sheet relates to those for threading bolts, another those for pipe, and another those for ratchet pattern for pipe. Size of page, 5½x8½ inches.

The Long Arm System Company, Cleveland, O., has brought out a pamphlet devoted to the "Long Arm" system of power doors and hatch gears for the preservation of life and property at sea. Those interested in the subject will find here extensive information concerning it. Size of the pamphlet, standard, 6x9 inches.

A catalog of profiling machines has come from the Garvin Machine Company, Spring and Varick streets, New York. Nos. 0, 1, 2, 3 and 4 are considered. The details of construction, such as Wesson system of drive and the universal joint used, are explained. A line of duplex milling machines is also briefly mentioned in the pamphlet, which is 6x9 inches, standard size.

The Cleveland Pneumatic Tool Company, 74 Frankfort street, Cleveland, O., has sent us a new catalog of its pneumatic hammers, drills and other appliances. A line of long-stroke hammers and a line of air hoists are among them. The catalog is copiously illustrated with views of the tools, both by themselves and as applied to their respective kinds of work. It is 6x9 inches, standard size.

Manufacturers.

An additional building, 100x116 feet, is to be erected by the Owego (N. Y.) Bridge Company.

A plant is to be fitted up at Lafayette, Ind., for the Duncan Electric Manufacturing Company.

A plant is about to be built at Niles, O., for the Ohio Manufacturing & Galvanizing Company.

The Barberton Pottery Company is being organized to build a 360x150-foot plant near Barberton, O.

Work has begun at Moundsville, W. Va., on buildings of the United States Lamp & Stamping Company.

The Camden (N. J.) White Lead Works have taken out a permit to erect two new factory buildings.

Plans have been drawn by the Wheeling (W. Va.) Roofing & Cornice Company for a proposed new plant.

An addition, 160x60 feet, is to be built to the plant of the Bowden Felting Mills Company, Millbury, Mass.

The plant at South Wellston, O., of the Alma Portland Cement Company, of Philadelphia, has been burned.

Important repairs and improvements are to be made at the West Albany (N. Y.) shops of the Central-Hudson Railroad.

Plans have been completed for a $500,000 plant with cold storage for the Fargo (N. D.) Packing & Cold Storage Company.

A. C. Ranrolph & Co., Newton, Ia., manufacturers of straw stackers, propose to erect a new factory as soon as spring opens.

The Struthers Furnace Company, Struthers, O., has plans completed for a new stack, which will have a capacity of 600 tons.

The Fischer Foundry & Machine Company, Pittsburgh, Pa., will soon enlarge its foundry and make other improvements to its plant.

The new factory that is to be erected by the Clipper Lawn Mower Company, Norristown, Pa., will be 40x150 feet, three stories.

Simpson Brothers, Pittsburgh, Pa., have purchased ground at Canonsburg, Pa., and will erect a new plant to make gas ranges, etc.

The Clyde Iron Works, foundry and machine shop, Duluth, Minn., have bought land on which they will probably erect new buildings.

Henry Timken, St. Louis, Mo., will erect a $100,000 plant at Canton, O., where he will manufacture patent roller-bearing carriage axles.

The American Separator Company, Bainbridge, N. Y., is fitting up a new building which it has purchased as an enlargement of its plant.

The Warner-Quinlan Asphalt Company has secured land for a plant at Syracuse, N. Y. The company is said to have a plant at Tremley, N. J.

It is reported that an independent steel mill is to be built at Sharpsville, Pa., by the Oliver & Snyder Steel Company, of Pittsburgh, Pa.

The Girard Locomotive & Construction Company has been granted a charter at Camden, N. J., with an authorized capital stock of $100,000.

Montgomery Brothers, Philadelphia, Pa., will erect a two-story building, 27x110 feet, for the manufacture of rubber goods and steam packing.

The recently burned plant at Waukegan, Ill., of the West Coast Manufacturing Company, Chicago, manufacturer of asphalt roofing, is being rebuilt.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant : see p. 26.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Light and fine mach'y to order ; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

Mechanical drawing and designing, by experienced man. 1st Floor, 899 N. 41st St., Philadelphia, Pa.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Special tools, models, fine light mach'y and foundry work wanted. Murray Mfg. Co., Richmond Valley, Staten Island, N. Y.

Administrator has for sale, cheap, a machine repair shop, 1 acre of ground and building, in good town of 6,000. H. C. Black, Glen Karn, Ohio.

A young man in Philadelphia, with a thoroughly equipped machine shop, desires to manufacture some specialty. H. Bartol Brazier, 1811 Fitzwater st., Philadelphia, Pa.

High-class machine design and drafting of all kinds done at reasonable rates by a responsible engineering firm : ideas developed ; all business confidential. C. & N., care A. M.

Purchaser for small manufacturing plant ; lot, 100x180 feet ; machine shop, 32x68, two story, with line shaft and gasoline power ; foundry, 40x54, new modern equipment ; good location ; for sale cheap. Hart-Parr Co., Madison, Wis.

Party with medium size, modern, up-to-date machine shop equipment, that can and will remove to another locality, can learn of an unusually good opportunity to form valuable associations by addressing, with details, "Permanent Business," care AMER. MACHINIST.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

First-class mechanical draftsman is open for engagement. Box 192, AMER. MACH.

Experienced mechanical draftsman wants a position. Box 213, AMERICAN MACHINIST.

Expert cost man, systemizer and estimator, desires change. Box 216, AMER. MACHINIST.

Mechanical draftsman, 7 years' experience, wants position. Box 225, AMER. MACHINIST.

Mechanical draftsman with experience wishes position. Box 226, AMER. MACHINIST.

By first-class paternmaker; technical education; draftsman; age 26; near New York city. Box 218, AMERICAN MACHINIST.

Experienced draftsman wants experimental work; would work out or improve some machine; references. Box 228, AMER. MACH.

Practical draftsman and superintendent, experienced in automobile and gas engine building. "Designer," care AMERICAN MACHINIST.

Mechanical engineer, first-class designer and draftsman for paper and pulp mill machinery, wants position. Box 215, AMER. MACHINIST.

Up-to-date superintendent seeks position of responsibility; experienced on engine, electrical, machine tools, automatic machinery. Box 214, AMERICAN MACHINIST.

Position as designing engineer, by technical man with 18 years' experience on machine tools, general and electrical machinery. Box 224, AMERICAN MACHINIST.

Mechanical draftsman, technical man, 8 years' experience, special and automatic machinery, tools, jigs and fixtures, desires change; best references. Box 227, AM. M.

Mechanical engineer, of wide experience in designing and superintending the manufacture of engines, boilers, electrical machinery, etc., is open for engagement. Address Box 194, AMERICAN MACHINIST.

Near New York city, by young man, age 26, as assistant engineer; practical experience; technical education; reliable; thoroughly familiar with drawing and machinery. Box 217, AMERICAN MACHINIST.

Position as assistant engineer or assistant manager with a concern manufacturing small refrigerating machines, by a technical graduate; good draftsman. Address Box 229, AMERICAN MACHINIST.

Superintendent or general foreman, machine line, 14 years' varied experience, executive ability, success handling men, now employed, wishes to change; good reasons given. Box 103, AMERICAN MACHINIST.

Young man, can make his usefulness felt as clerk in machinery salesroom; thoroughly acquainted with the various makes of machine tools, etc.; best of reference furnished. Address Box 223, AMERICAN MACHINIST.

Machine shop foreman, at present employed; young; energetic; 6 years foreman of large manufacturing concern erecting waterworks engines and general pumping machinery; best references. Box 230, AM. MACH.

Experienced mechanical engineer, good designer of plants and machinery of all kinds, well acquainted with the rotary kiln process of cement manufacture, desires suitable position; best references. Box 231, AMER. MACH.

Position as superintendent or general foreman; am conversant with the machine business in all its branches, a designer of tools, jigs and modern appliances for economical production. Box 163, AMERICAN MACHINIST.

Position wanted by A1 machinist and tool and die maker, as superintendent or foreman; would prefer a reliable party in New York or vicinity, to take up the manufacture of a new perfect automatic steel die engraving machine; finest reference as to ability and character. Address "Perfect," care AM. MACH.

Position as superintendent or manager desired by mechanical engineer with extensive experience in manufacture of fine interchangeable machinery; mechanical and executive ability unquestionable; at present superintendent of large works; highest references. Address Box 222, AMERICAN MACHINIST.

Practical superintendent of 15 years' experience; familiar with both methods of manufacturing and contracting shops; capable of handling from 100 to 400 men; familiar with every detail of shop management from the drafting room down; East or Middle States preferred. Address Box 104, AMER. MACH.

Superintendent is open for position; just completed a term of 7 years as superintendent, having entire charge of a typewriter factory employing about 230 hands in the manufacture of a high-grade machine; was mechanically trained at Pratt & Whitney's, and have had long and responsible experience elsewhere; particulars at interview; age 44. Box 212, AMERICAN MACHINIST.

Help Wanted.

Working foreman for erecting floor of electrical factory. "Alternator," care AM. M.

Wanted—A few good men to work on erecting floor. Watertown Engine Co., Watertown, N. Y.

Wanted—First-class draftsman to lay out boiler and steam plants. Box 210, AMERICAN MACHINIST.

Wanted—First-class machinists on engine work; no labor trouble. Address Reeves Machine Co., Trenton, N. J.

Wanted—First-class draftsman, familiar with erection of gas and oil engines. Box 211, AMERICAN MACHINIST.

Wanted—First-class patternmaker; to competent man good wages will be paid. Address Box 197, AMERICAN MACHINIST.

Wanted—An experienced mechanical foreman with knowledge of electricity. Address, with references, Box 207, AMER. MACHINIST.

We are starting a new plant and invite application from first-class wood pattern makers and machinists. Address De Laval Steam Turbine Co., Trenton, N. J.

Good patternmakers, both wood and metal, desiring steady employment, will find it to their advantage to apply to the General Electric Co., Schenectady, N. Y.

Wanted—Mechanical draftsman having experience on large vertical Corliss engine work. Please address, giving experience and all particulars, Box 209, AMERICAN MACHINIST.

Wanted—Foreman for a drop forging shop in middle Massachusetts; must be man of experience and ability. Address, giving references, age and experience, Box 100, AM. M.

Wanted.

Automatic Screw Machines and Forming Machines, ranging in sizes up to 3 inches; must be late patterns, in good condition, at a reasonable price.

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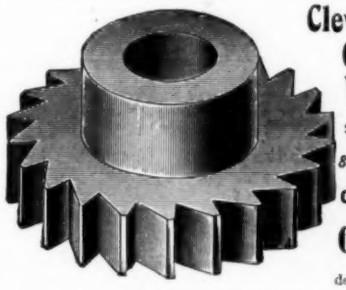
Cincinnati, Ohio.

OHIO STATE UNIVERSITY, COLUMBUS, College of Engineering. Nine four year courses leading to Engineering degrees. Three short courses. Total expense, including all fees, board, room and books, may be under $200 00. Many students are self-supporting. Credit given for shop and drawing room experience. Catalog on application to executive office.



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The new plant of the Lawrence Ice & Storage Company, New Castle Pa., has been gutted by fire. The damage is estimated at $150,000.

Lortz & Teutcher, manufacturers of iron bedsteads, Utica, N. Y., have purchased a new building in which they will install electricity for light and power.

The United States Drawn Steel Company, of Buffalo, N. Y., is negotiating with the Real Estate Exchange of McKeesport, Pa., for a manufacturing site.

It is reported from Oregon that the American Can Company has decided to build a new can factory there, which may be located in Astoria or Portland.

The Newport News (Va.) Shipbuilding & Dry Dock Company is to make improvements, including the installation of new electric cranes and other machinery.

The ten mills at the Shenango plant of the American Tin Plate Company, New Castle, Pa., have been put in full operation and the works are now running full.

The plant of the Canton & Malvern Firebrick Paving Company, Malvern, O., which was recently destroyed by fire, will be rebuilt with double its former capacity.

The Middletown Manufacturing Company, maker of metallic bedsteads, Middletown, Henry County, Ind., is making arrangements to put up an additional building.

The Kokomo Steel Wire & Nail Company, Kokomo, Ind., has placed the contract for its iron and wood pulleys with the Vonnegut Hardware Company, Indianapolis.

C. H. Hopke, Rockford, Ill., who has been associated with the American Foundry Company, is about to build a new foundry, which will employ some seventy-five men at first.

It is reported that a company, of which Gen. Joe Wheeler is a director, is contemplating the establishment of a plant in Philadelphia for the manufacture of a new firearm.

It is believed that operations will soon be resumed at the Warren, Ohio, plant of the National Tube Company. Examination of the plant showed that the machinery was in good shape.

It is quite probable that the Chester Park car shops of the Cincinnati (O.) Traction Company will be increased and will make cars for the other companies of the Widener-Elkins Syndicate.

Fire in the plant of the Pittsburgh Oil Refining Company at Coraopolis, Pa., has destroyed the main refining building, the wax house, compound houses, filtering houses and boiler house.

It is confidently stated that the Stanard Milling Company, of St. Louis, Mo., has let a contract to rebuild the mill recently destroyed by fire at Alton, Ill., though official confirmation is said to be denied.

A pipe and rolling mill may be built at Columbia, Pa., either by the Susquehanna Iron & Steel Company, of Philadelphia and Columbia, or by John Q. Denney, of that company, and other persons.

The factory of the Brooklyn Glycerine Manufacturing Company, Greenpoint, Brooklyn, N. Y., has been gutted by fire, which started in the boiler-room. Much valuable machinery was destroyed.

Fire in Boston, Mass., November 12, destroyed the local plant of the Murphy Varnish Company, of Newark, N. J., and a steam power plant owned by Mayor Hart, which supplied power to several buildings.

The shareholders in the Lowe Manufacturing Company, cottons, Huntsville, Ala., have voted to increase the capital stock to $200,000, which indicates that the capacity of the Lowe cotton mill will be doubled.

Arrangements are being made to rebuild

the foundry and machine shops of Kenney & Co., Scottdale, Pa. It is stated that a stock company will be organized and that the new concern will add largely to the machinery equipment.

Additions are planned for the next year by Deere & Mansur Company, manufacturer of agricultural implements, Moline, Ill., which will cost $200,000 or $300,000 and increase the capacity of the factory by almost half what it is now.

The Jupiter Steel & Coal Company, recently organized under the laws of West Virginia, is preparing to install machinery in the buildings formerly occupied by the Pennsylvania Lead Works in Carnegie, Pa., and will manufacture tool steel.

If the Minneapolis & St. Paul Railroad becomes consolidated under the Illinois Central's management, as is reported to have been arranged for, it is expected that the shops of these roads in Fort Dodge, Ia., will be combined and enlarged.

The Taylor Signal Company, a Buffalo, N. Y., corporation that has been in business less than eighteen months, has decided to double its capacity. The new building will be 250 feet long and two stories high. An office building will also be built.

The Middletown Car Works, Middletown, Pa., has been granted a charter with a capital stock of $100,000. The parties interested are Arthur King and Geo. I. King, Middletown, and Paul L. Kunkel, Harrisburg. The newly organized concern will operate the works now standing idle.

News comes from Detroit, Mich., that the Detroit River Sugar Company, of which D. W. Simons is president, O. R. Baldwin, vice-president, and J. C. Dumont, engineer, has completed designs for a factory in Ecorse, Mich., which is to have a capacity for 500 tons of beets a day.

The Brown & Zortman Machinery Company, Pittsburgh, Pa., and the Taylor-Wilson Company have taken contracts for machinery equipment for the new addition to the plant of the Sharon Steel Company, Sharon, Pa. The contract calls for threading, tapping and cutting-off machines.

A new company, composed of Otto Hauer & Bros., has been formed at Alton Park, near Chattanooga, Tenn., for the purpose of manufacturing cedar pencil slats, and it is contemplated spending $15,000 on the two buildings and the machinery. A 100 horse-power engine will be installed.

Permits have been issued to the Pennsylvania Railroad for a number of new buildings at Pittsburgh, Pa. One allows the construction of eight two-story shops and a round-house for the Pittsburgh, Virginia & Charleston, at a cost of $100,000. The others provide for signal towers.

The J. D. Smith Foundry Supply Company, proprietor of the Cleveland Facing Mills, is erecting a large addition to its plant at Cleveland, O. Warehouse capacity for machinery and supplies has been increased by leasing the five-story building at 36-40 South Water street, in that city.

John Leggett & Son, manufacturers of paper boxes, Troy, N. Y., who recently purchased the plant of the Glens Falls Box Company, will build a new factory at Glens Falls, N. Y. It will be fitted up with the latest improved machinery and will have steam and electricity as motive power.

An application will be made November 29 for a charter for the York Bridge Company, York, Pa. The application is being made by G. P. Lehner, of Pittsburgh; Guy Webster, N. P. Webster, C. J. Drury and George W. Drury, of York. The company proposes to erect a plant about 210x40 feet, with a boiler-house.

Help Wanted—Continued.

Wanted—A traveling salesman to sell a machine tool specialty; must have a fair knowledge of machinery and be able to develop into a specialist. Box 219, AM. MACH.

Wanted—Foreman of drop forging die department in middle Massachusetts; must be man of experience and ability. Address, giving references, age and experience, Box 101, AMERICAN MACHINIST.

Wanted—At once, a practical, experienced gas engine man as superintendent of old-established concern; state age, experience and wages expected; give references. Elmore Mfg. Co., Clyde, Ohio.

Wanted—Experienced man to operate Brown & Sharpe grinder on small tool work; permanent position; state age, experience and wages expected; works near Worcester, Mass. Box 198, AMERICAN MACHINIST.

Wanted—Draftsman for crane department, with technical education and some experience in hoisting machinery or similar lines. Address, with full details as to qualification, Industrial Works, Bay City, Mich.

Draftsman for detail work on special and automatic machinery; must have had shop experience; preferably one acquainted with the working of sheet metals; good position for right man. Address Box 220, AMER. MACH.

Wanted—A first-class foundry foreman in a foundry making a specialty of Corliss engines, hoisting engines, air compressors and a general line of loam and green sand castings. Address "A," care AMER. MACHINIST.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

A good mechanical draftsman for out-of-town position; one who has had experience in designing heavy machinery preferred; applicants will state previous experience, references, age and salary expected. Box 188, AMERICAN MACHINIST.

Wanted—First-class gas engine painter, competent to take charge of from 30 to 50 painters, and must be thoroughly posted as to fillers, mixing paints and finishing; give experience and wages expected. Address Box 199, AMERICAN MACHINIST.

Shop superintendent, capable of handling the manufacturing end of a concern employing upwards of 400 men on gas and steam engines, stand pipes and heavy plate work; modern and well-equipped shop. Address Box 153, AMERICAN MACHINIST.

Wanted—Draftsman and mechanical engineer who has had practical shop experience to design machine tools; new concern and good opportunity for right man; location in Western Pennsylvania; state age, experience and salary expected. Address Box 208, AM. M.

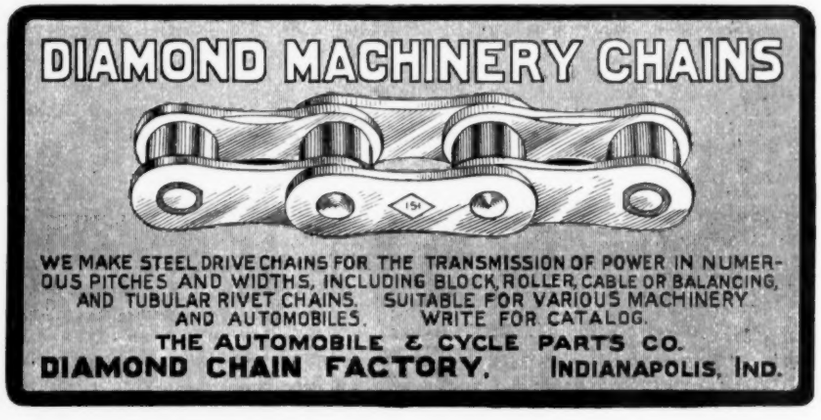
Wanted—Superintendent for foundry and machine shop manufacturing brass fittings for engines and boilers, including injectors and lubricators; want man with experience and executive ability and capable of designing. Address "Injector," care AMER. MACHINIST.

Superintendent for growing shop in Ohio, now employing 50 men, making light special machinery; want a thorough manufacturer to jig up and cut costs, who can handle the whole mechanical side; position has a future for a good man; state experience and salary. Box 221, AMERICAN MACHINIST.

Wanted—A competent and energetic draftsman, about 33 to 35 years, up in modern methods, to take charge of small machine shop; good pay to right man; one familiar with bleaching and dyeing machinery preferred. Address, giving full information and wages expected, B. B., 32 Kent st., Somerville, Mass.

Wanted—A young, up-to-date, thorough machinist, who has had experience in handling men, competent to act as foreman in agricultural implement works in a large Western city; must possess executive ability. Address, stating age, experience, salary wanted and references, "Agricultural," care AM. M.

Wanted—By a large concern with factory in New England, manufacturing small, light and complex machinery, a strictly first-class, high-grade mechanical engineer and machine designer; must be experienced, have proper recommendations, and be able to show some work of merit already accomplished; an unusual opportunity. Address R. S. Lemon, Fullerton Building, St. Louis, Mo.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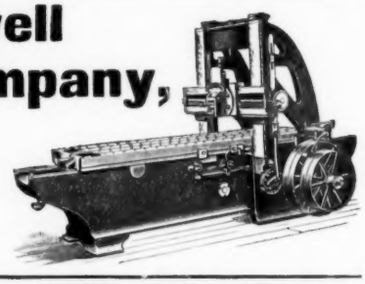
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